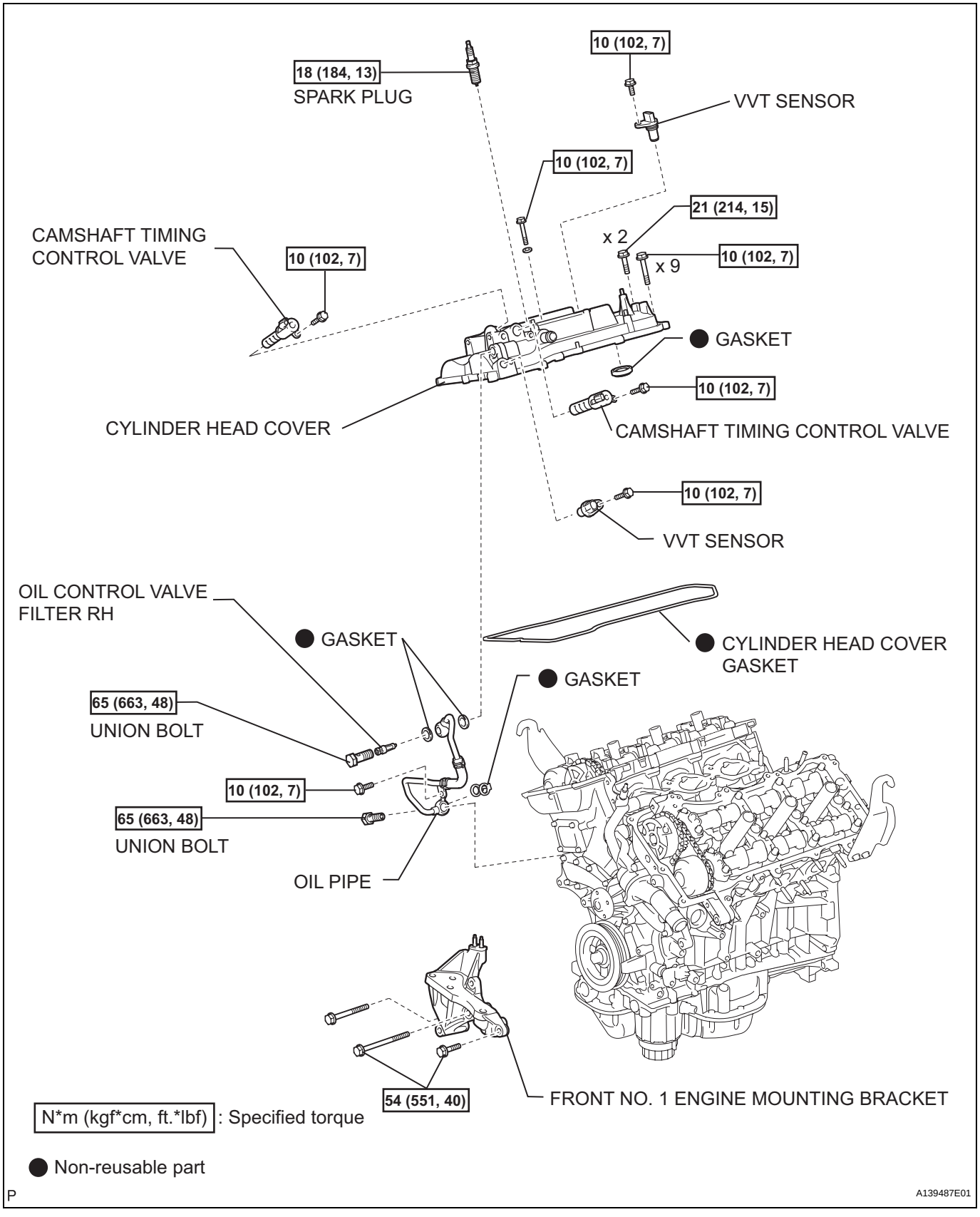
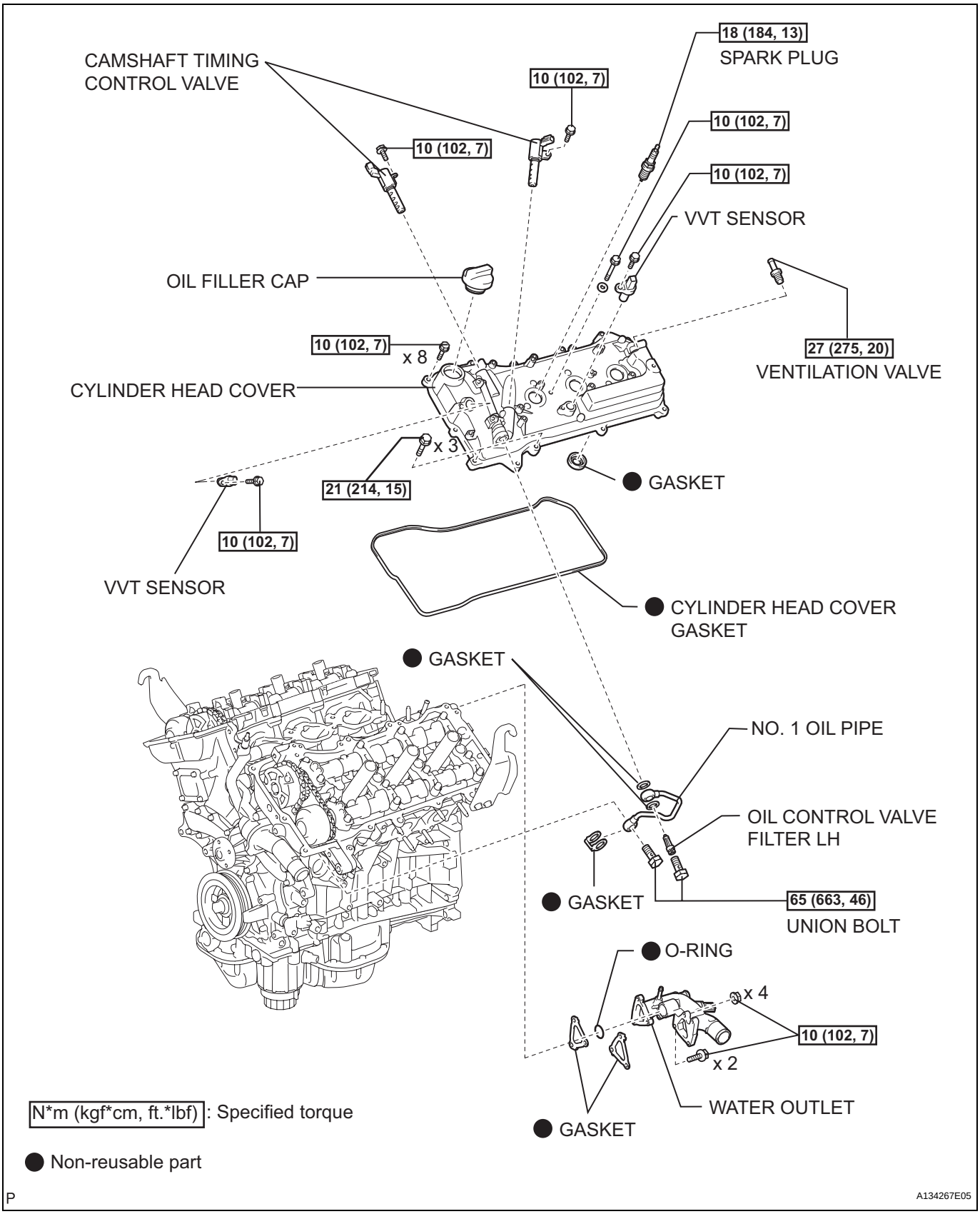
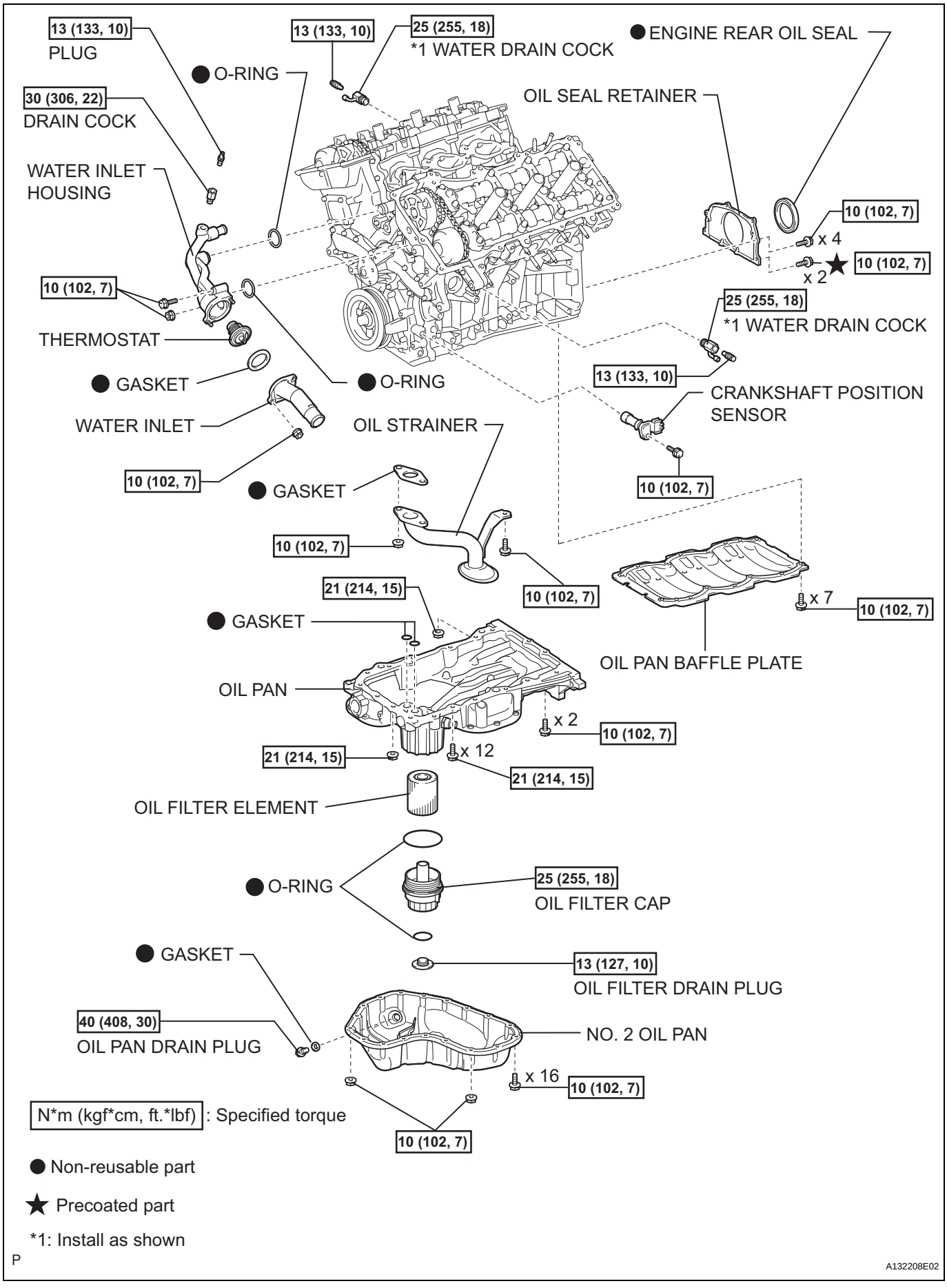
ENGINE UNIT

COMPONENTS

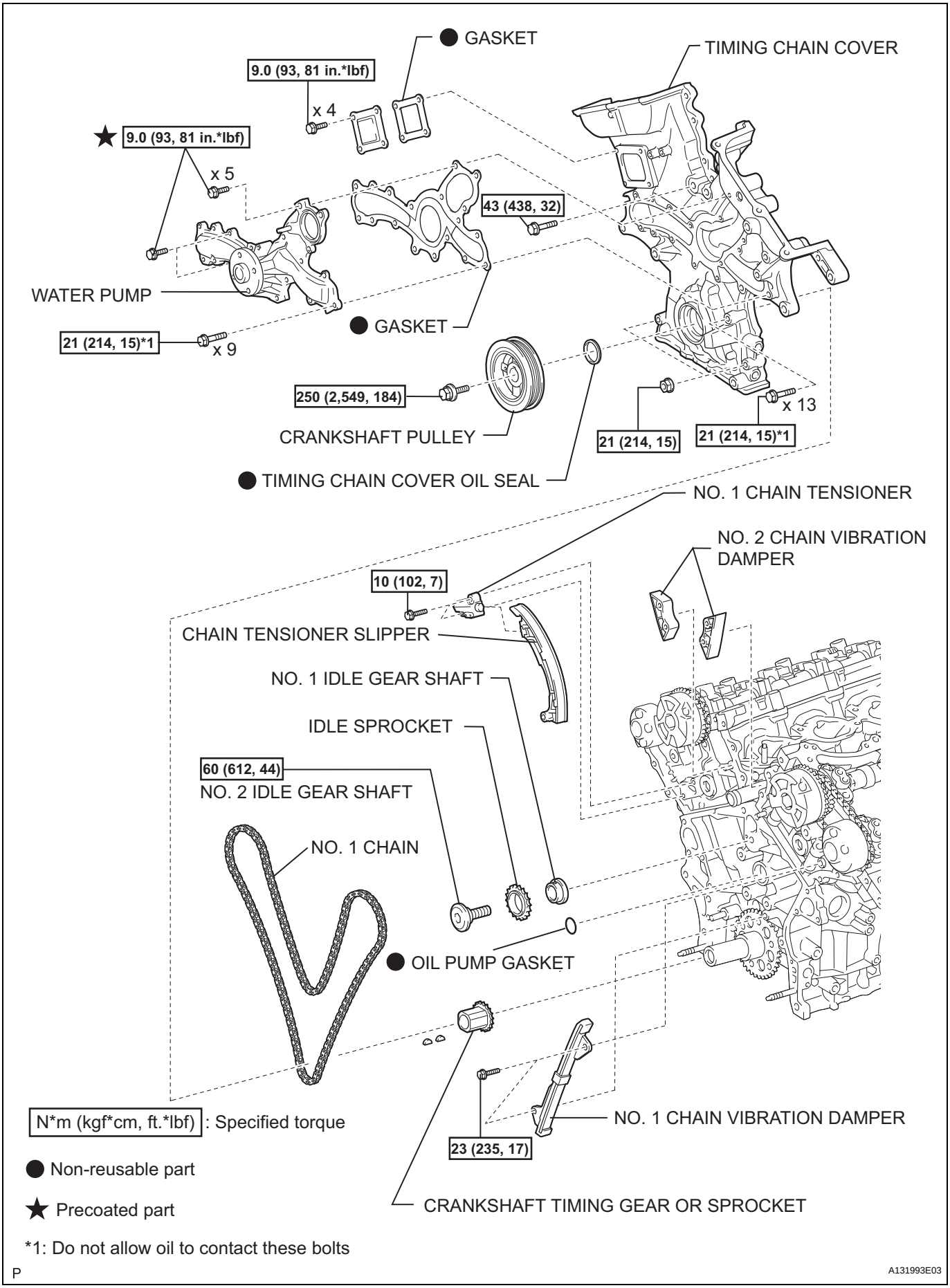


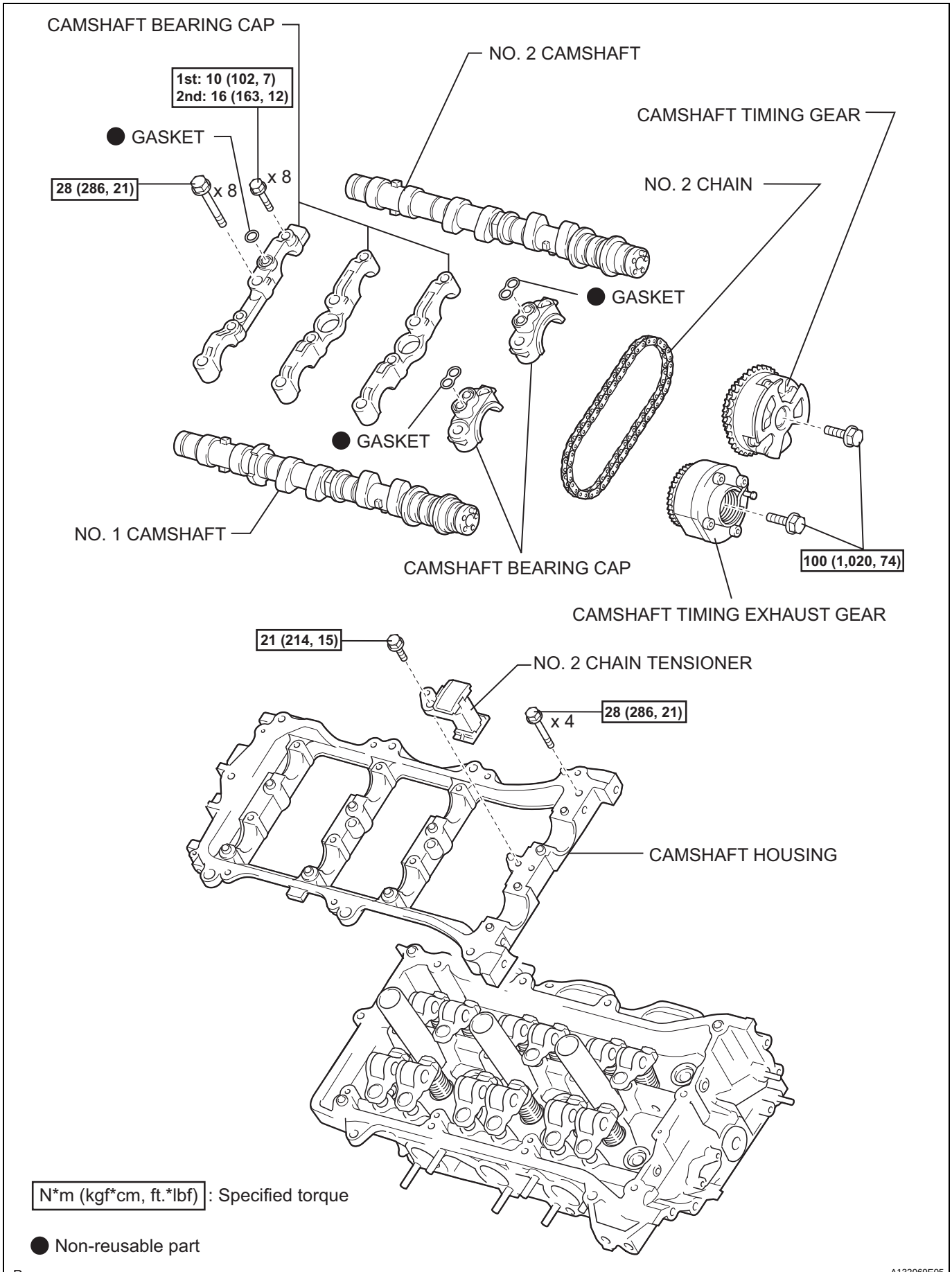
EM


CAMSHAFT TIMING CONTROL VALVE
10 (102, 7)
10 (102, 7)
18 (184, 13)
SPARK PLUG
10 (102, 7)
10 (102, 7)
VVT SENSOR
OIL FILLER CAP
10 (102, 7)
x 8
CYLINDER HEAD COVER
27 (275, 20)
VENTILATION VALVE
x 3
21 (214, 15)
GASKET
10 (102, 7)
VVT SENSOR
CYLINDER HEAD COVER GASKET
GASKET
NO. 1 OIL PIPE
OIL CONTROL VALVE FILTER LH
GASKET
65 (663, 46)
UNION BOLT
O-RING
x 4
10 (102, 7)
x 2
WATER OUTLET
GASKET
N*m (kgf*cm, ft.*lbf): Specified torque
Non-reusable part
A134267E05

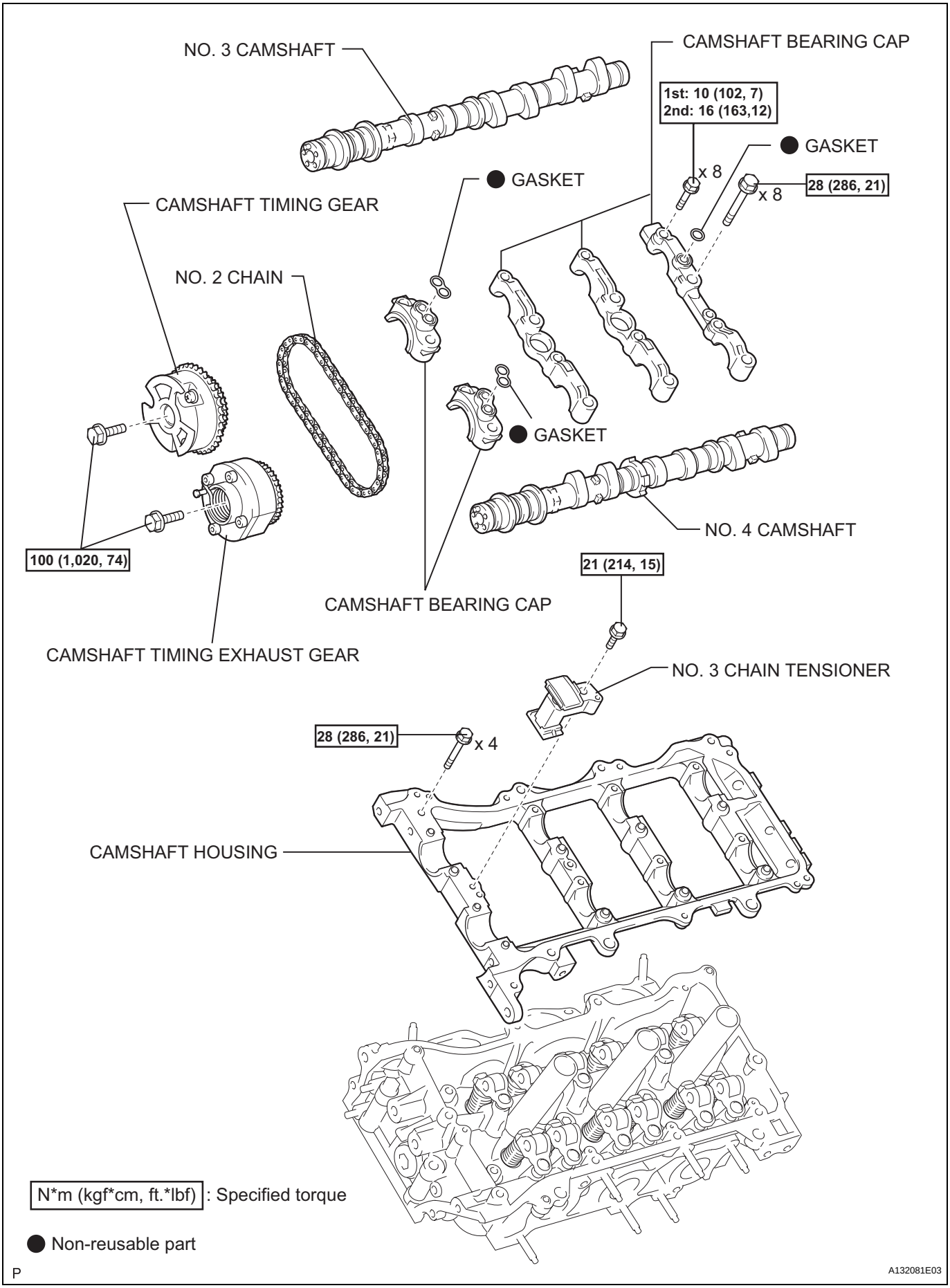

13 (133, 10)
PLUG
13 (133, 10)
25 (255, 18)
*1 WATER DRAIN COCK
ENGINE REAR OIL SEAL
O-RING
30 (306, 22)
DRAIN COCK
OIL SEAL RETAINER
WATER INLET HOUSING
10 (102, 7)
x 4
10 (102, 7)
x 2
10 (102, 7)
25 (255, 18)
*1 WATER DRAIN COCK
THERMOSTAT
GASKET
O-RING
13 (133, 10)
CRANKSHAFT POSITION SENSOR
WATER INLET
OIL STRAINER
10 (102, 7)
10 (102, 7)
GASKET
10 (102, 7)
10 (102, 7)
21 (214, 15)
x 7
10 (102, 7)
GASKET
OIL PAN BAFFLE PLATE
OIL PAN
x 2
10 (102, 7)
21 (214, 15)
x 12
21 (214, 15)
OIL FILTER ELEMENT
O-RING
25 (255, 18)
OIL FILTER CAP
GASKET
13 (127, 10)
OIL FILTER DRAIN PLUG
40 (408, 30)
OIL PAN DRAIN PLUG
NO. 2 OIL PAN
x 16
10 (102, 7)
10 (102, 7)
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
Precoated part
*1: Install as shown
P
A132208E02

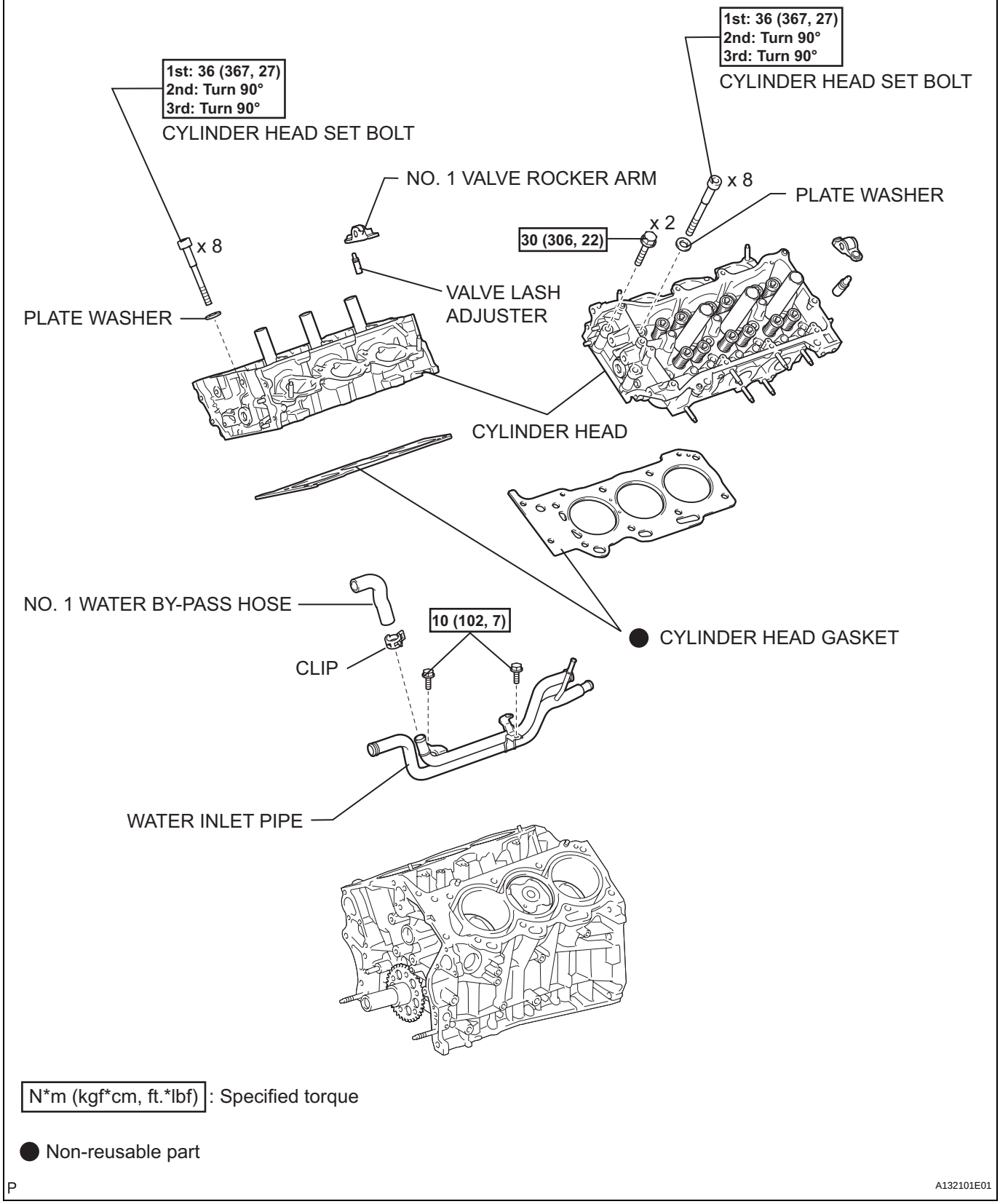
EM


GASKET
TIMING CHAIN COVER
9.0 (93, 81 in.*lbf)
x 4
★ 9.0 (93, 81 in.*lbf)
x 5
43 (438, 32)
WATER PUMP
GASKET
21 (214, 15)*1
x 9
250 (2,549, 184)
CRANKSHAFT PULLEY
21 (214, 15)
21 (214, 15)*1
x 13
TIMING CHAIN COVER OIL SEAL
NO. 1 CHAIN TENSIONER
NO. 2 CHAIN VIBRATION DAMPER
10 (102, 7)
CHAIN TENSIONER SLIPPER
NO. 1 IDLE GEAR SHAFT
IDLE SPROCKET
60 (612, 44)
NO. 2 IDLE GEAR SHAFT
NO. 1 CHAIN
OIL PUMP GASKET
NO. 1 CHAIN VIBRATION DAMPER
23 (235, 17)
CRANKSHAFT TIMING GEAR OR SPROCKET
N*m (kgf*cm, ft.*lbf) : Specified torque
● Non-reusable part
★ Precoated part
*1: Do not allow oil to contact these bolts
A131993E03


CAMSHAFT BEARING CAP
NO. 2 CAMSHAFT
1st: 10 (102, 7)
2nd: 16 (163, 12)
CAMSHAFT TIMING GEAR
GASKET
28 (286, 21)
x 8
x 8
NO. 2 CHAIN
GASKET
GASKET
NO. 1 CAMSHAFT
CAMSHAFT BEARING CAP
100 (1,020, 74)
CAMSHAFT TIMING EXHAUST GEAR
21 (214, 15)
NO. 2 CHAIN TENSIONER
28 (286, 21)
x 4
CAMSHAFT HOUSING
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A132069E05

EM


NO. 3 CAMSHAFT
CAMSHAFT BEARING CAP
1st: 10 (102, 7)
2nd: 16 (163,12)
GASKET
x 8
28 (286, 21)
x 8
GASKET
CAMSHAFT TIMING GEAR
NO. 2 CHAIN
GASKET
NO. 4 CAMSHAFT
100 (1,020, 74)
21 (214, 15)
CAMSHAFT BEARING CAP
CAMSHAFT TIMING EXHAUST GEAR
NO. 3 CHAIN TENSIONER
28 (286, 21)
x 4
CAMSHAFT HOUSING
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A132081E03



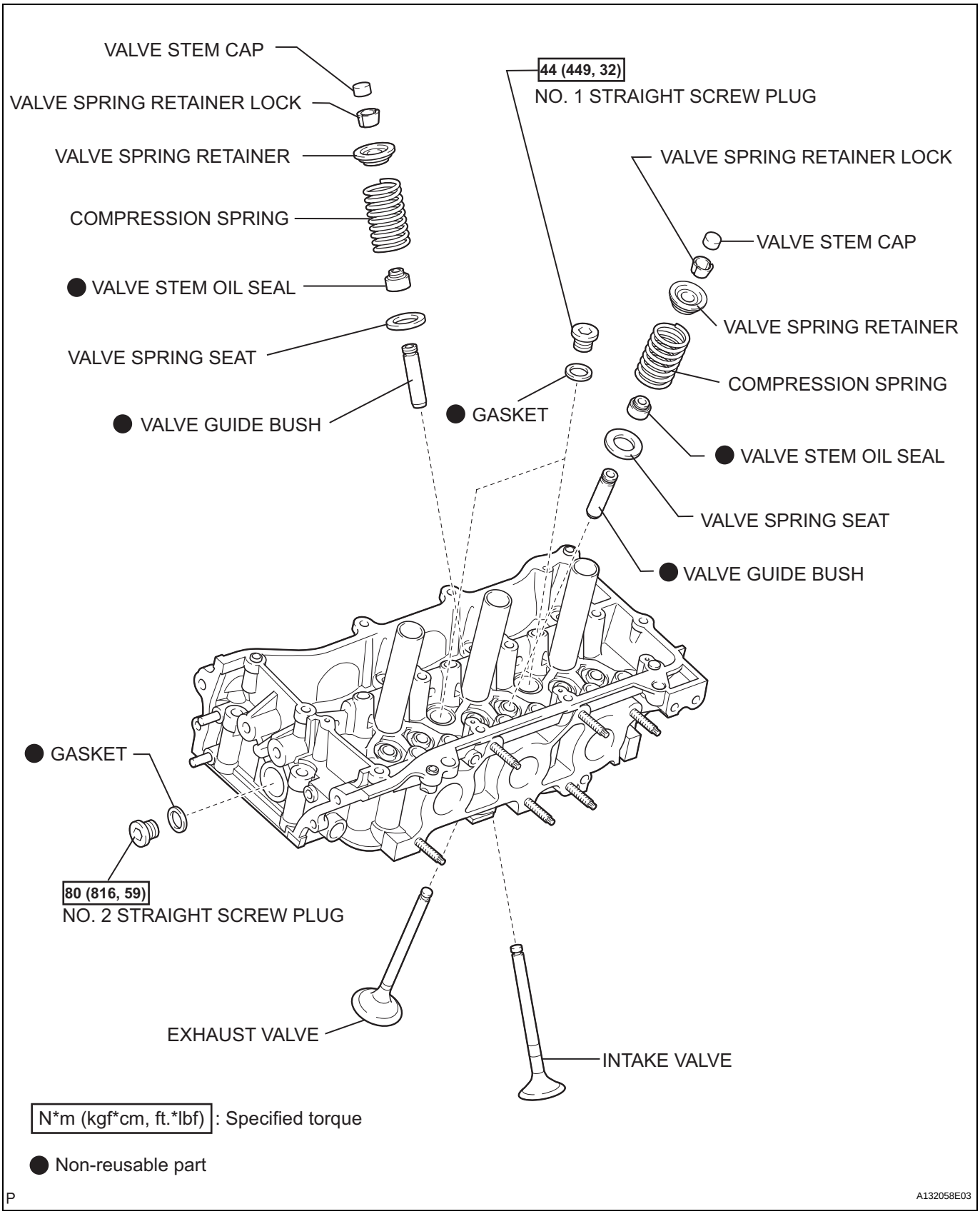
N*m (kgf*cm, ft.*lbf) : Specified torque

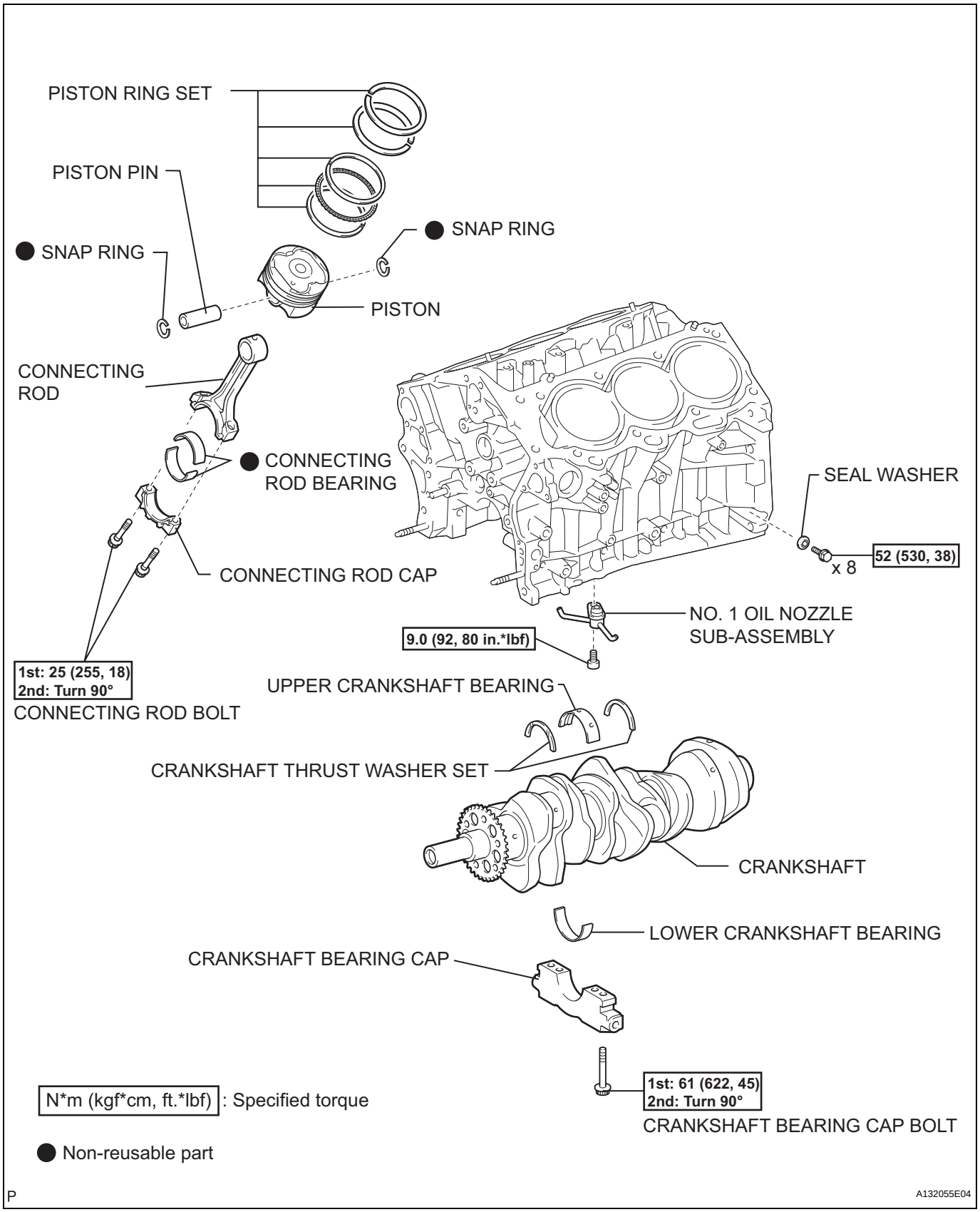
● Non-reusable part

P

A132101E01

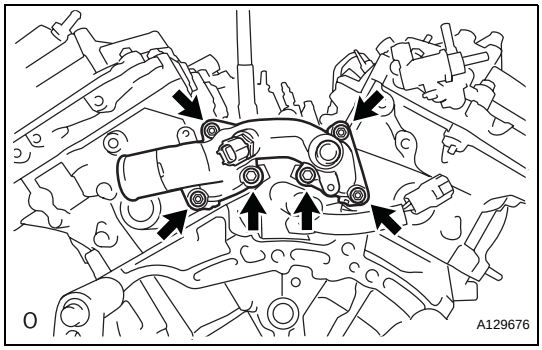
EM


VALVE STEM CAP
VALVE SPRING RETAINER LOCK
VALVE SPRING RETAINER
COMPRESSION SPRING
● VALVE STEM OIL SEAL
VALVE SPRING SEAT
● VALVE GUIDE BUSH
44 (449, 32)
NO. 1 STRAIGHT SCREW PLUG
● GASKET
VALVE SPRING RETAINER LOCK
VALVE STEM CAP
VALVE SPRING RETAINER
COMPRESSION SPRING
● VALVE STEM OIL SEAL
VALVE SPRING SEAT
● VALVE GUIDE BUSH
● GASKET
80 (816, 59)
NO. 2 STRAIGHT SCREW PLUG
EXHAUST VALVE
INTAKE VALVE
N*m (kgf*cm, ft.*lbf) : Specified torque
● Non-reusable part
P
A132058E03

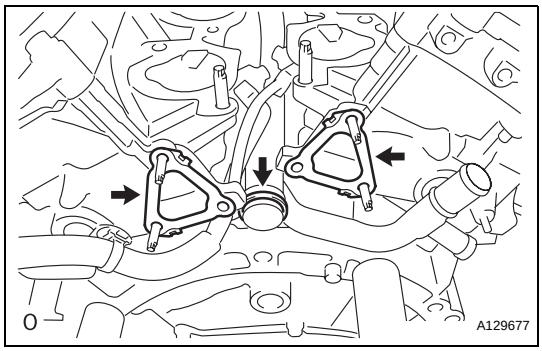

PISTON RING SET
PISTON PIN
SNAP RING
SNAP RING
PISTON
CONNECTING ROD
CONNECTING ROD BEARING
CONNECTING ROD CAP
1st: 25 (255, 18)
2nd: Turn 90°
CONNECTING ROD BOLT
SEAL WASHER
52 (530, 38)
x 8
NO. 1 OIL NOZZLE SUB-ASSEMBLY
9.0 (92, 80 in.*lbf)
UPPER CRANKSHAFT BEARING
CRANKSHAFT THRUST WASHER SET
CRANKSHAFT
LOWER CRANKSHAFT BEARING
CRANKSHAFT BEARING CAP
1st: 61 (622, 45)
2nd: Turn 90°
CRANKSHAFT BEARING CAP BOLT
N*m (kgf*cm, ft.*lbf) : Specified torque
Non-reusable part
P
A132055E04

DISASSEMBLY

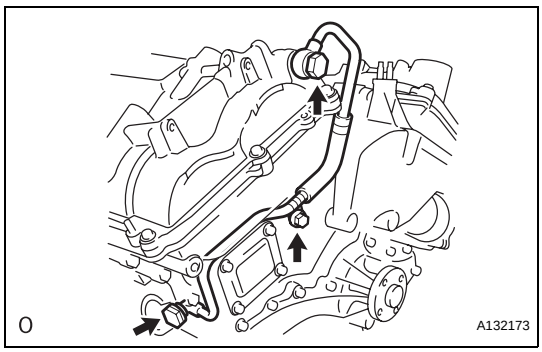
1. **REMOVE OIL FILLER CAP SUB-ASSEMBLY**
2. **REMOVE SPARK PLUG**
3. **REMOVE CAMSHAFT TIMING CONTROL VALVE ASSEMBLY (See page ES-440)**
4. **REMOVE VVT SENSOR (See page ES-443)**
5. **REMOVE WATER OUTLET**
   (a) Remove the 2 bolts, 4 nuts and water outlet.



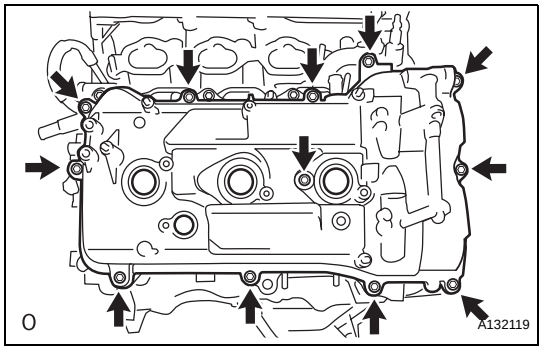
   (b) Remove the 2 gaskets and O-ring.

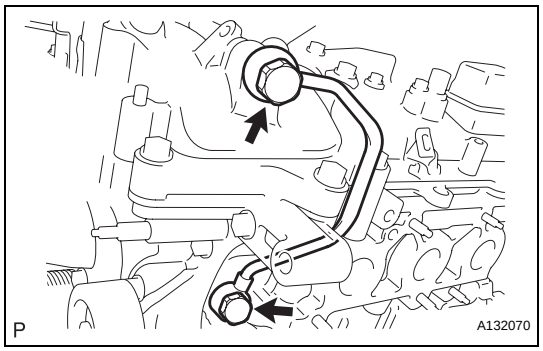


6. **REMOVE OIL PIPE**
   (a) Remove the bolt, 2 union bolts and oil pipe.
   (b) Remove the oil control valve filter RH and gaskets.

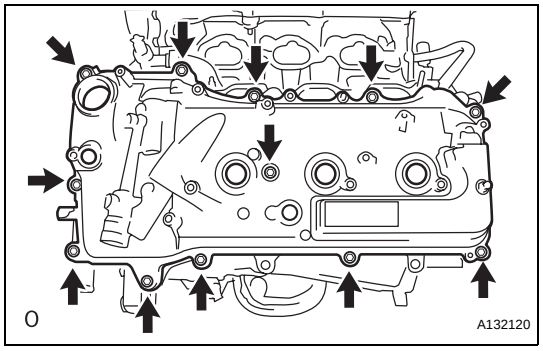


7. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 1)**
   (a) Remove the 12 bolts, cylinder head cover and gasket.
   HINT:
   Make sure the removed parts are returned to the same places they were remove a from.

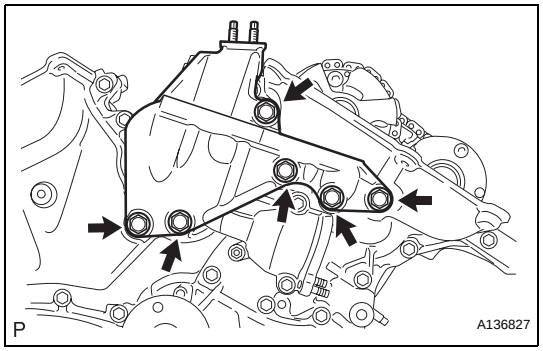




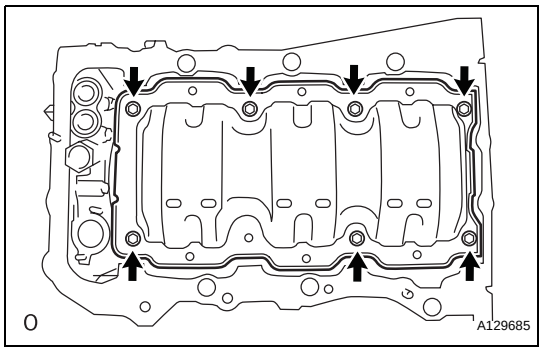
8. **REMOVE NO. 1 OIL PIPE**
   (a) Remove the 2 union bolts and oil pipe.
   (b) Remove the oil control valve filter LH and gaskets.



9. **REMOVE CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 2)**
   (a) Remove the 12 bolts, cylinder head cover and gasket.
   HINT:
   Make sure the removed parts are returned to the same places they were remove a from.

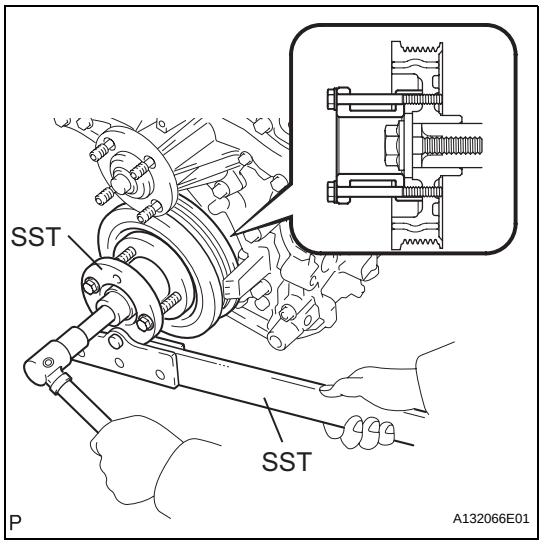


10. **REMOVE FRONT NO. 1 ENGINE MOUNTING BRACKET**
    (a) Remove the 6 bolts and mounting bracket.
11. **REMOVE WATER INLET HOUSING (See page CO-12)**
12. **REMOVE OIL FILTER CAP ASSEMBLY (See page LU-4)**
13. **REMOVE OIL FILTER ELEMENT (See page LU-5)**
14. **REMOVE NO. 2 OIL PAN SUB-ASSEMBLY (See page LU-12)**
15. **REMOVE OIL STRAINER SUB-ASSEMBLY (See page LU-13)**
16. **REMOVE OIL PAN SUB-ASSEMBLY (See page LU-13)**



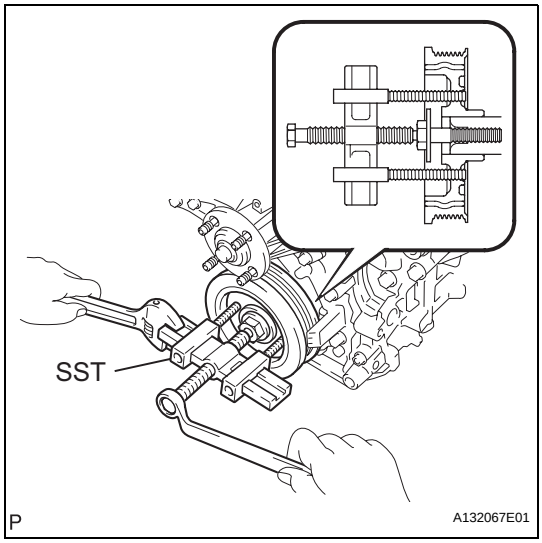
17. **REMOVE OIL PAN BAFFLE PLATE**
    (a) Remove the 7 bolts and baffle plate.

EM



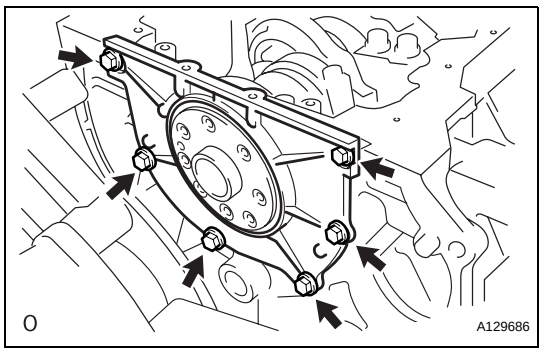
18. REMOVE CRANKSHAFT PULLEY

(a) Using SST, loosen the crankshaft pulley set bolt.
SST 09213-70011 (09213-70020), 09330-00021



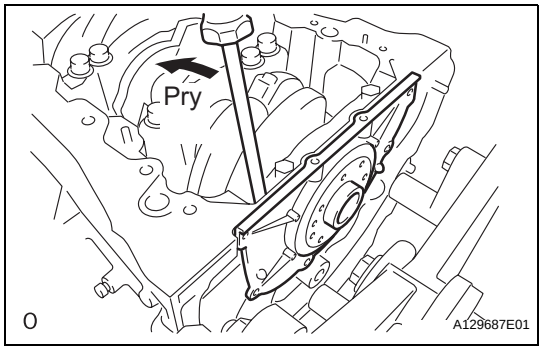
(b) Using the pulley set bolt and SST, remove the crankshaft pulley.
SST 09950-50013 (09951-05010, 09952-05010, 09953-05020, 09954-05021)

19. REMOVE WATER PUMP ASSEMBLY (See page CO-13)



20. REMOVE ENGINE REAR OIL SEAL RETAINER

(a) Remove the 6 bolts.

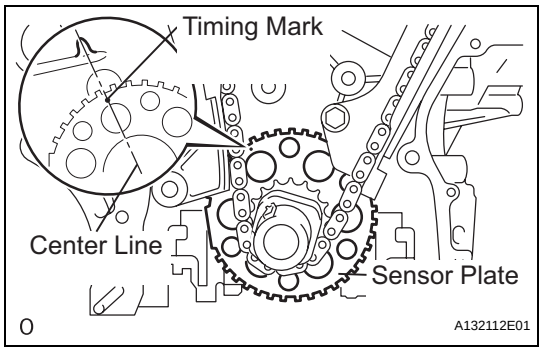


(b) Using a screwdriver, pry out the oil seal retainer.
HINT:
Tape the screwdriver tip before use.

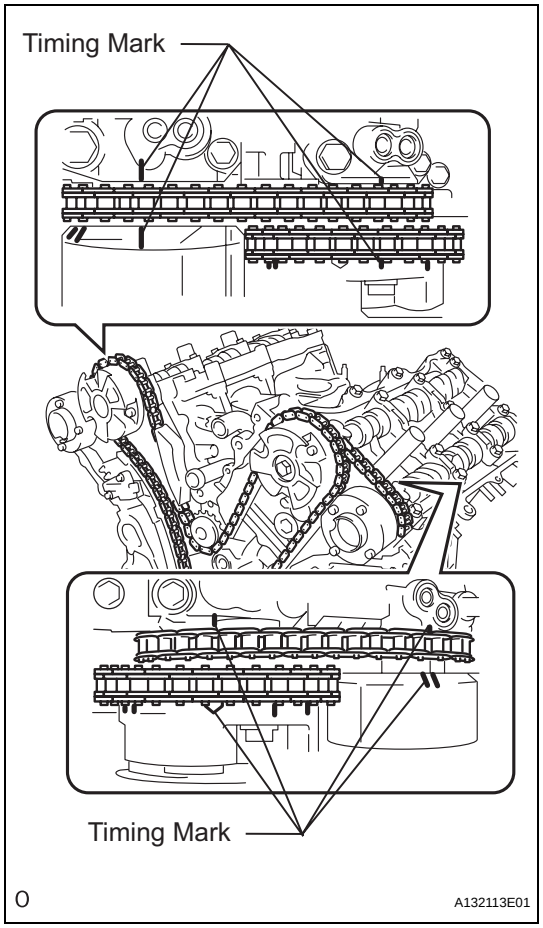
21. REMOVE TIMING CHAIN COVER SUB-ASSEMBLY (w/ Oil Pump) (See page LU-14)

22. SET NO. 1 CYLINDER TO TDC / COMPRESSION

(a) Temporarily tighten the pulley set bolt.

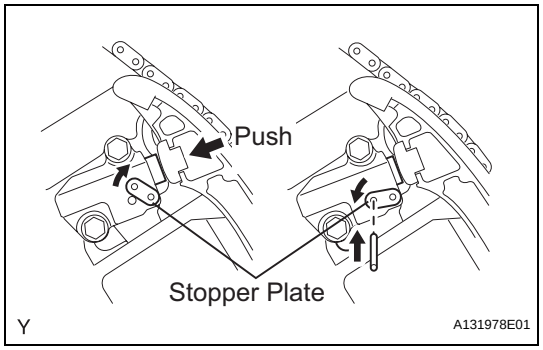


(b) Set the timing mark on the crank angle sensor plate to the RH block bore center line (TDC / compression).



(c) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration. If not, turn the crankshaft 1 revolution (360°) and align the timing marks as above.

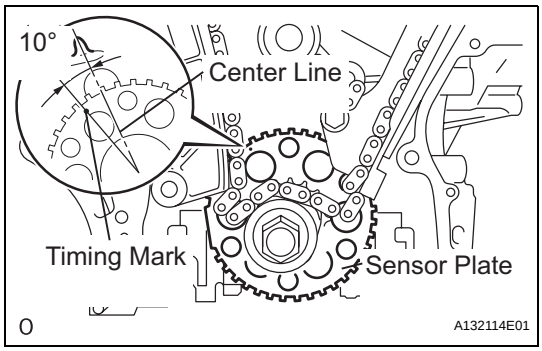
EM



23. REMOVE NO. 1 CHAIN TENSIONER ASSEMBLY

(a) Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.
(b) Move the stopper plate downward to set the lock, and insert a hexagon wrench into the stopper plate hole.
(c) Remove the 2 bolts and chain tensioner.

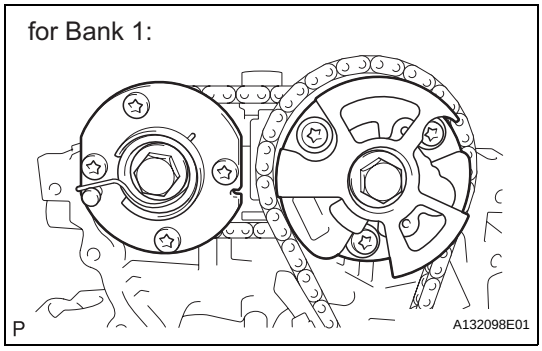
24. REMOVE CHAIN TENSIONER SLIPPER



25. REMOVE NO. 1 CHAIN SUB-ASSEMBLY

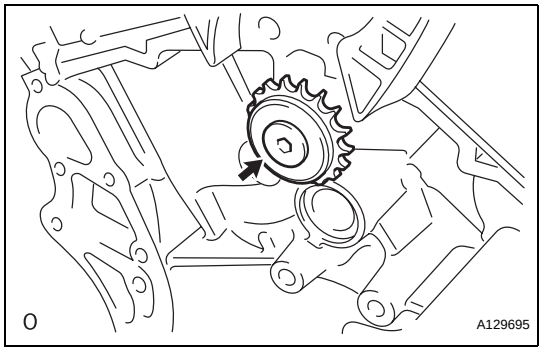
(a) Turn the crankshaft counterclockwise 10° to loosen the chain of the crankshaft timing gear.

(b) Remove the chain from the crankshaft timing gear and place it on the crankshaft.



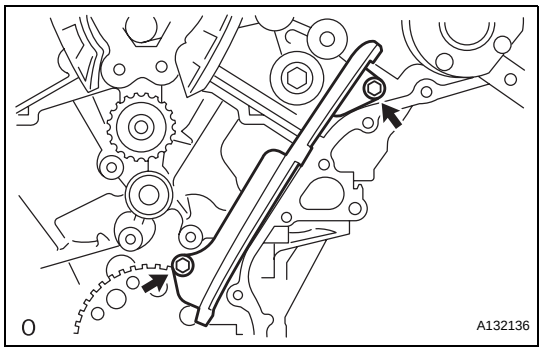
(c) Turn the camshaft timing gear on the RH bank clockwise (approximately 60°) and set it as shown in the illustration. Be sure to loosen the chain between the center banks.

(d) Remove the chain.



26. REMOVE IDLE SPROCKET ASSEMBLY

(a) Using a 10 mm hexagon wrench, remove the No. 2 idle gear shaft, idle sprocket and No. 1 idle gear shaft.



27. REMOVE NO. 1 CHAIN VIBRATION DAMPER

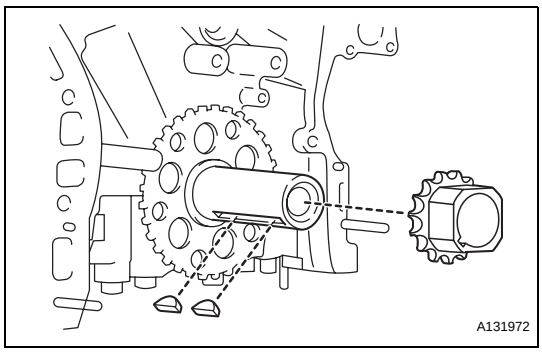
(a) Remove the 2 bolts and vibration damper.

28. REMOVE NO. 2 CHAIN VIBRATION DAMPERS

(a) Remove the 2 chain vibration dampers.

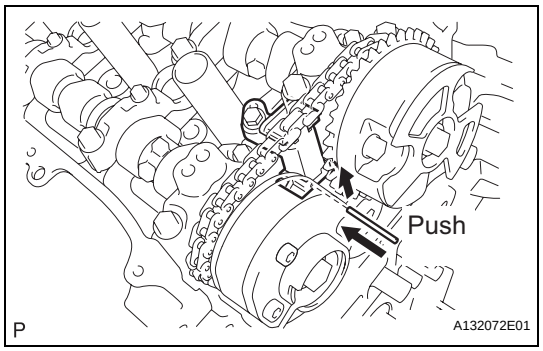
29. REMOVE CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Remove the pulley set bolt.



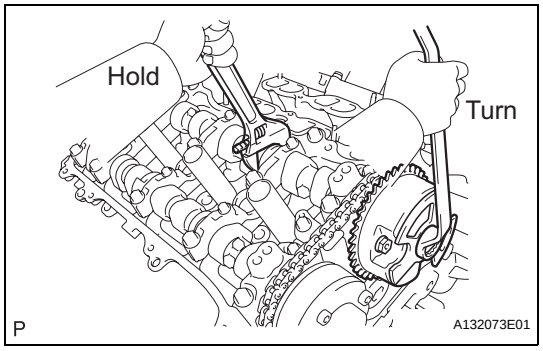
(b) Remove the crankshaft timing gear from the crankshaft.

(c) Remove the 2 pulley set keys from the crankshaft.



30. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY (for Bank 1)

(a) While raising up the No. 2 chain tensioner, insert a pin of ϕ1.0 mm (0.039 in.) into the hole to fix it in place.

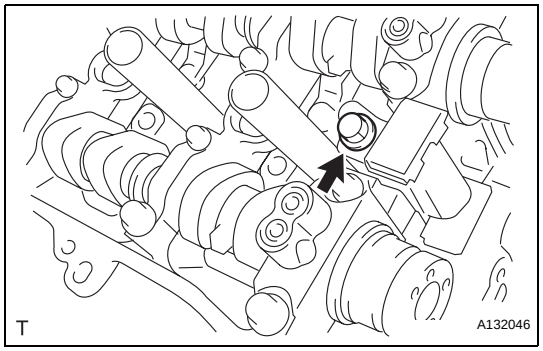


(b) Hold the hexagonal portion of the camshaft with a wrench, and remove the 2 bolts and 2 camshaft timing gears.

NOTICE:

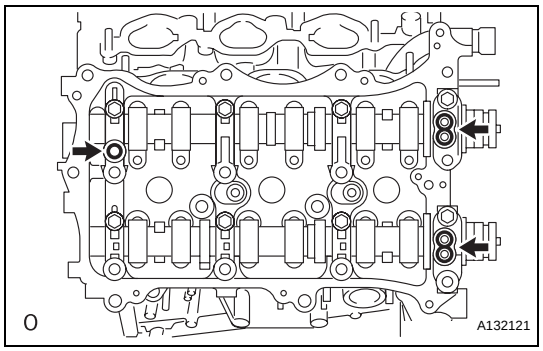
- **Be careful not to damage the cylinder head with the wrench.**
- **Do not disassemble the camshaft timing gear.**

(c) Remove the No. 2 chain.



31. REMOVE NO. 2 CHAIN TENSIONER ASSEMBLY

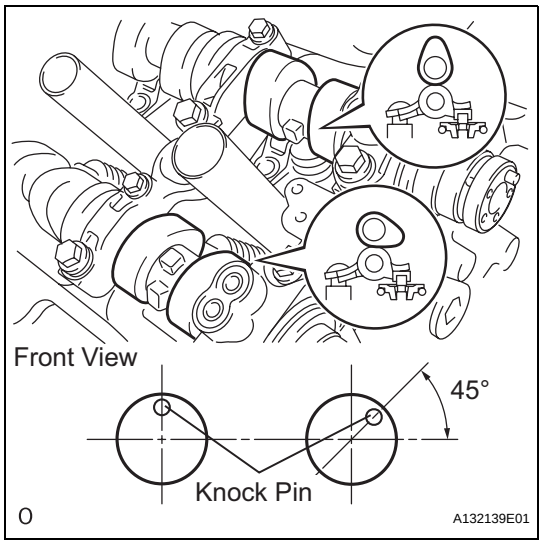
(a) Remove the bolt and chain tensioner.



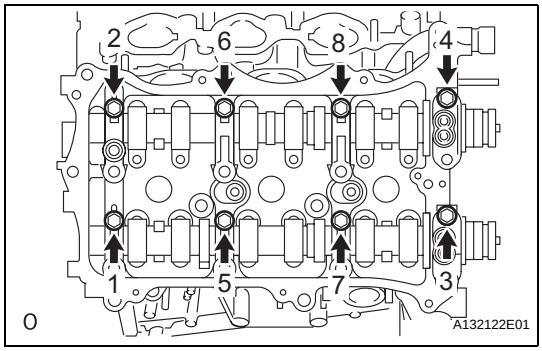
32. REMOVE CAMSHAFT (for Bank 1)

(a) Remove the 3 gaskets.

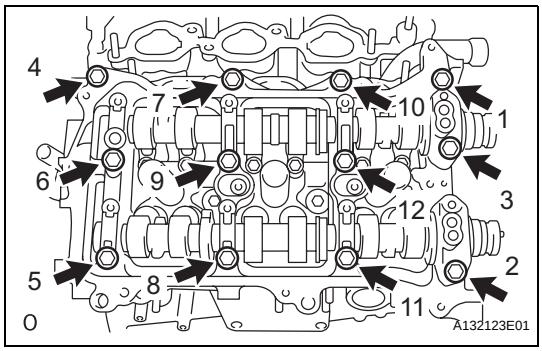
EM



(b) Make sure that the knock pin of the camshaft is positioned as shown in the illustration.



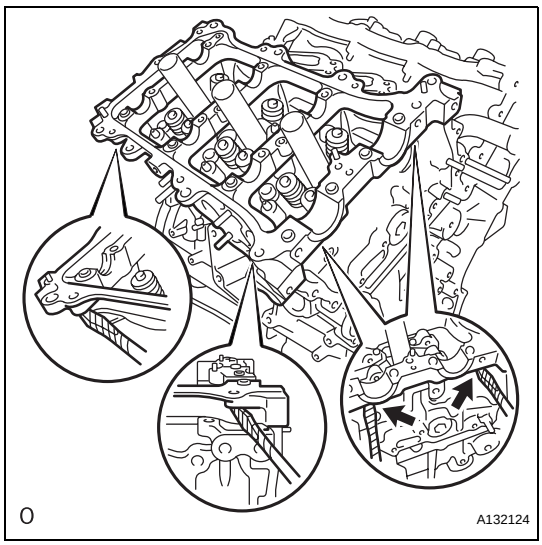
(c) Uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration.



(d) Uniformly loosen and remove the 12 bearing cap bolts in the sequence shown in the illustration.
NOTICE:
Uniformly loosen the bolts while keeping the camshaft level.

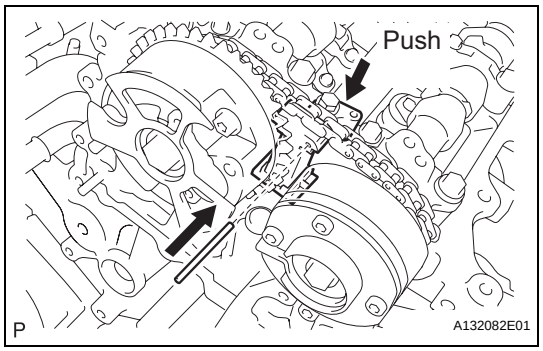
(e) Remove the 5 bearing caps.

(f) Remove the No. 1 and No. 2 camshafts.



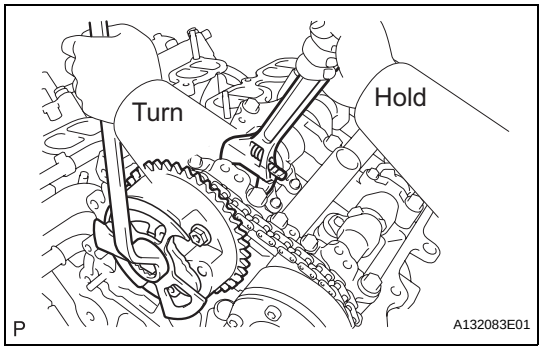
33. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY (for Bank 1)

(a) Remove the camshaft housing by prying between the cylinder head and camshaft housing with a screwdriver.
NOTICE:
Be careful not to damage the contact surfaces of the cylinder head and camshaft housing.
HINT:
Tape the screwdriver tip before use.



34. REMOVE CAMSHAFT TIMING GEAR ASSEMBLY (for Bank 2)

(a) While pushing down the chain tensioner, insert a pin of ϕ1.0 mm (0.039 in.) into the hole to fix it in place.

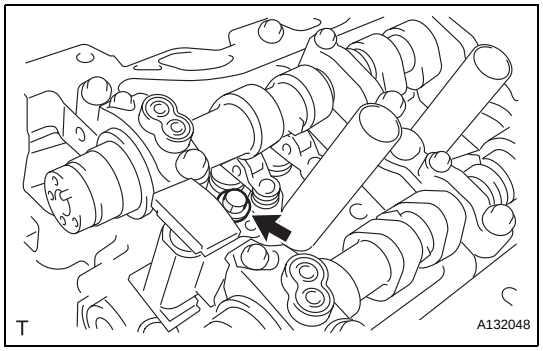


(b) Hold the hexagonal portion of the camshaft with a wrench and remove the 2 bolts and 2 camshaft timing gears.

NOTICE:

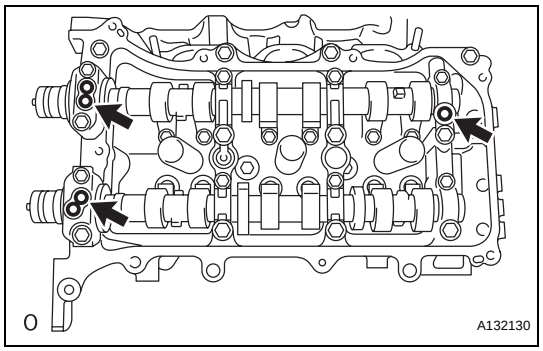
- **Be careful not to damage the cylinder head with the wrench.**
- **Do not disassemble the camshaft timing gear.**

(c) Remove the No. 2 chain.



35. REMOVE NO. 3 CHAIN TENSIONER ASSEMBLY

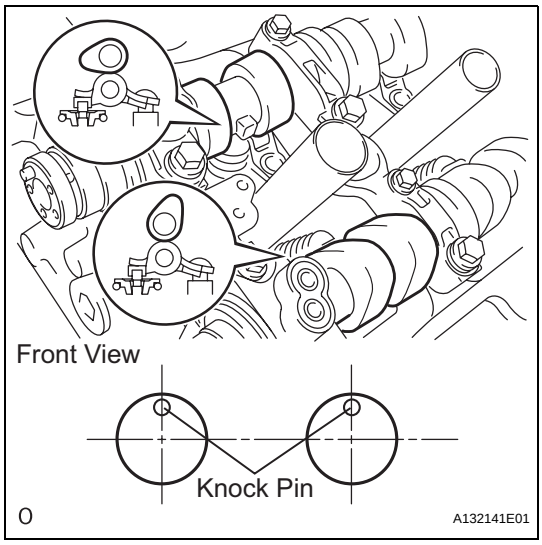
(a) Remove the bolt and chain tensioner.



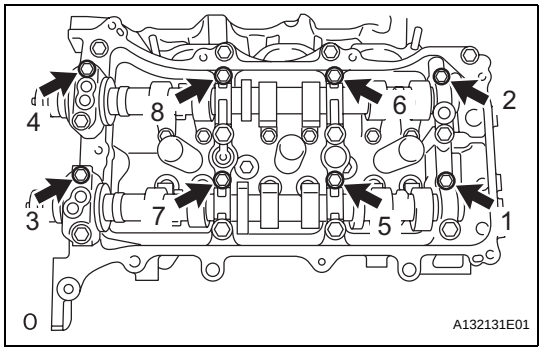
36. REMOVE CAMSHAFT SUB-ASSEMBLY (for Bank 2)

(a) Remove the 3 gaskets.

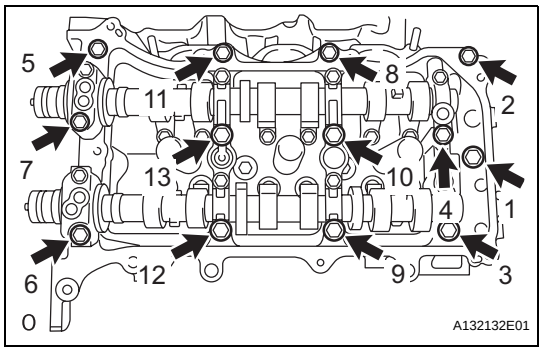
EM



(b) Make sure that the knock pin of the camshaft is positioned as shown in the illustration.



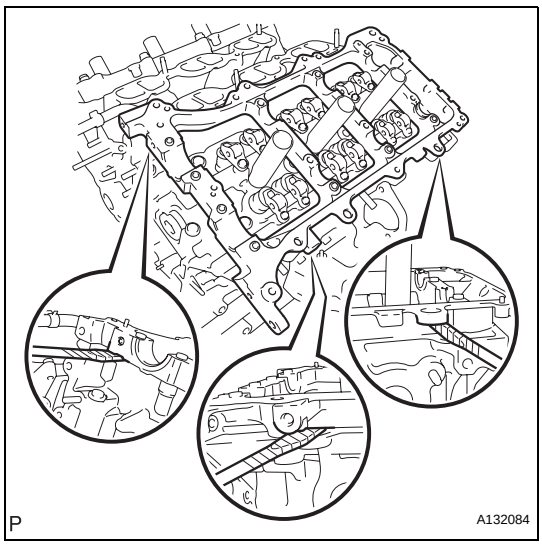
(c) Uniformly loosen and remove the 8 bearing cap bolts in the sequence shown in the illustration.



(d) Uniformly loosen and remove the 13 bearing cap bolts in the sequence shown in the illustration.
NOTICE:
Uniformly loosen the bolts while keeping the camshaft level.

(e) Remove the 5 bearing caps.

(f) Remove the No. 3 and No. 4 camshafts.



37. REMOVE CAMSHAFT HOUSING SUB-ASSEMBLY (for Bank 2)

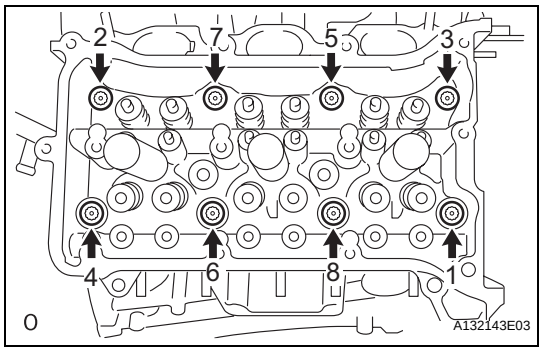
(a) Remove the camshaft housing by prying between the cylinder head and camshaft housing with a screwdriver.
NOTICE:
Be careful not to damage the contact surfaces of the cylinder head and camshaft housing.
HINT:
Tape the screwdriver tip before use.

38. REMOVE NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

(a) Remove the 24 valve rocker arms.
HINT:
Arrange the removed parts in the correct order.

39. REMOVE VALVE LASH ADJUSTER ASSEMBLY

(a) Remove the 24 valve lash adjusters from the cylinder head.
HINT:
Arrange the removed parts in the correct order.

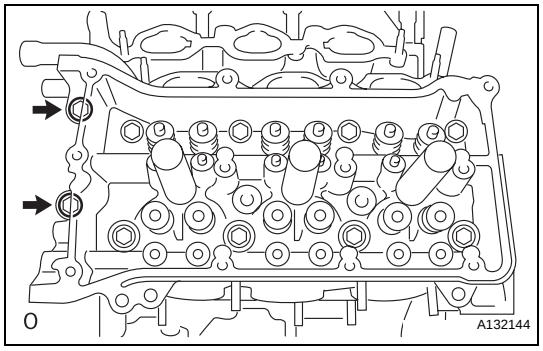


40. REMOVE CYLINDER HEAD SUB-ASSEMBLY (for Bank 1)

(a) Using a 10 mm bi-hexagon wrench, uniformly loosen the 8 bolts in the sequence shown in the illustration. Remove the 8 cylinder head bolts and plate washers.
NOTICE:
- **Be careful not to drop washers into the cylinder head.**
- **Head warpage or cracking could result from removing bolts in an incorrect order.**

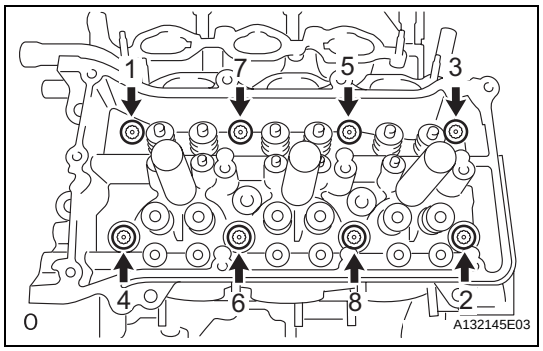
HINT:
Be sure to keep the removed parts separate for each installation position.

(b) Remove the cylinder head and gasket.



41. REMOVE CYLINDER HEAD SUB-ASSEMBLY (for Bank 2)

(a) Uniformly loosen and remove the 2 bolts in the sequence shown in the illustration.



(b) Using a 10 mm bi-hexagon wrench, uniformly loosen the 8 bolts in the sequence shown in the illustration. Remove the 8 cylinder head bolts and plate washers.
NOTICE:
- **Be careful not to drop washers into the cylinder head.**
- **Head warpage or cracking could result from removing bolts in an incorrect order.**

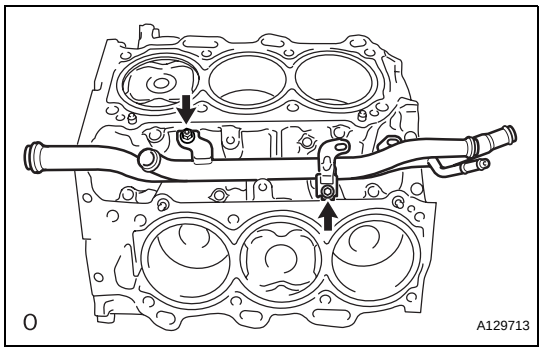
HINT:
Be sure to keep the removed parts separate for each installation position.

(c) Remove the cylinder head and gasket.

42. REMOVE WATER INLET PIPE

(a) Disconnect the knock sensor wire.

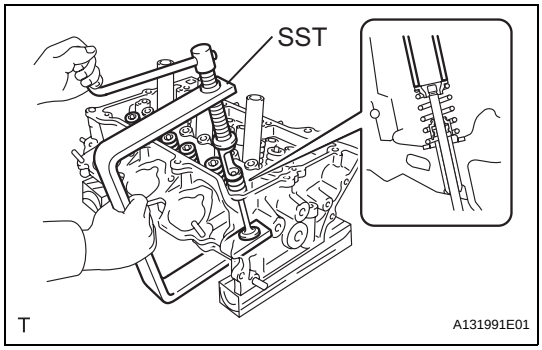
EM



(b) Remove the 2 bolts and water outlet pipe.
(c) Disconnect the water by-pass hose.

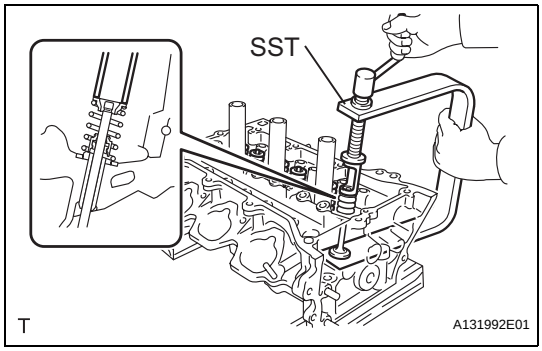
43. REMOVE VALVE STEM CAP

(a) Remove the valve stem caps from the cylinder head.
HINT:
Arrange the removed parts in the correct order.



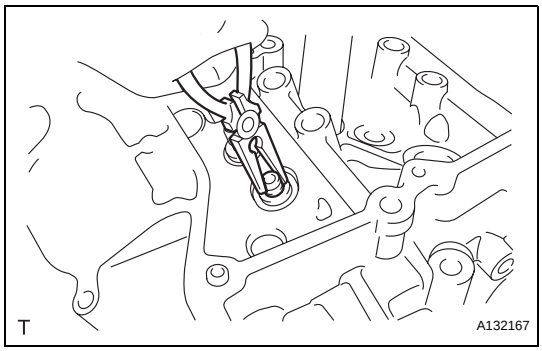
44. REMOVE INTAKE VALVE

(a) Using SST and wooden blocks, compress the compression spring and remove the valve retainer lock.
SST 09202-70020 (09202-00010)
(b) Remove the retainer, compression spring and valve.
HINT:
Arrange the removed parts in the correct order.



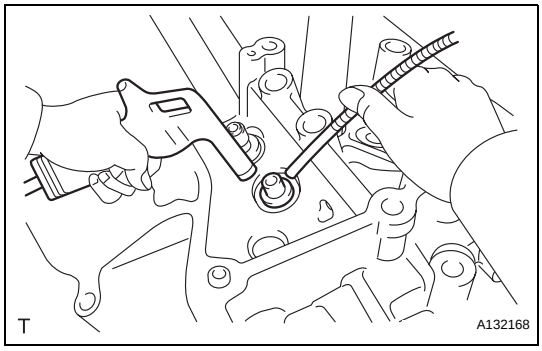
45. REMOVE EXHAUST VALVE

(a) Using SST and wooden blocks, compress the compression spring and remove the valve retainer lock.
SST 09202-70020 (09202-00010)
(b) Remove the retainer, compression spring and valve.
HINT:
Arrange the removed parts in the correct order.



46. REMOVE VALVE STEM OIL SEAL

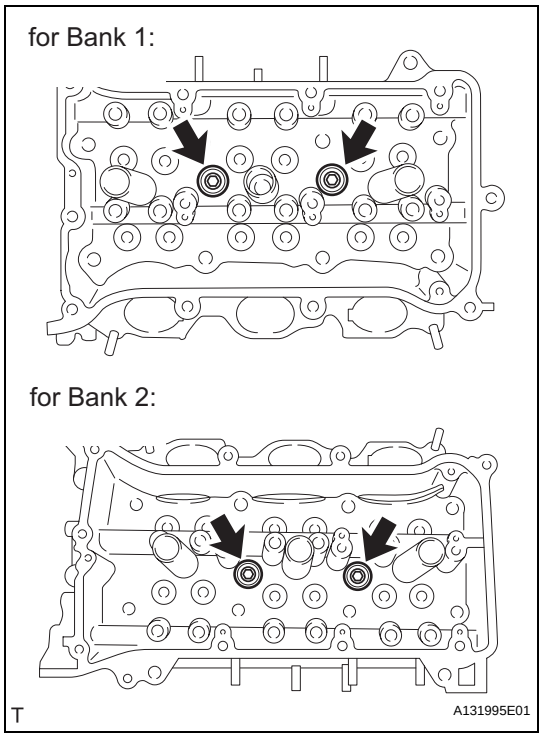
(a) Using needle-nose pliers, remove the oil seals.



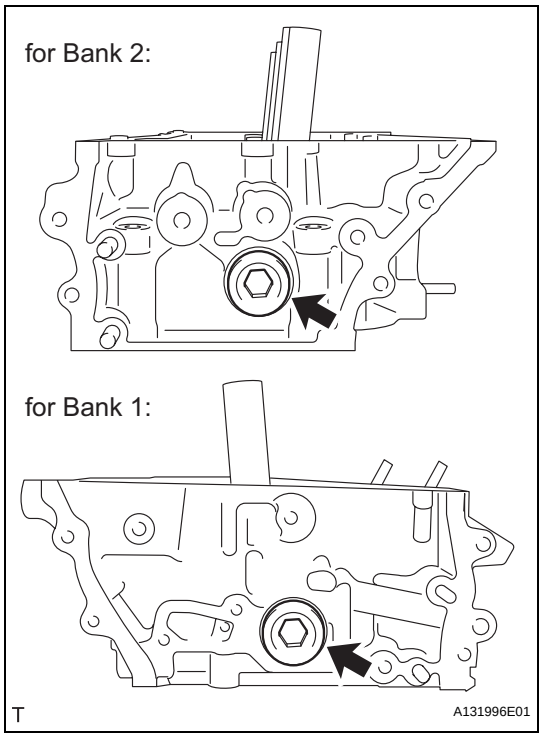
47. REMOVE VALVE SPRING SEAT

(a) Using compressed air and a magnetic finger, remove the valve spring seat by blowing air onto it.

48. REMOVE NO. 1 STRAIGHT SCREW PLUG
NOTICE:
If water leaks from the No. 1 screw plug or the plug is corroded, replace it.



(a) Using a 10 mm hexagon wrench, remove the 4 screw plugs and 4 gaskets.

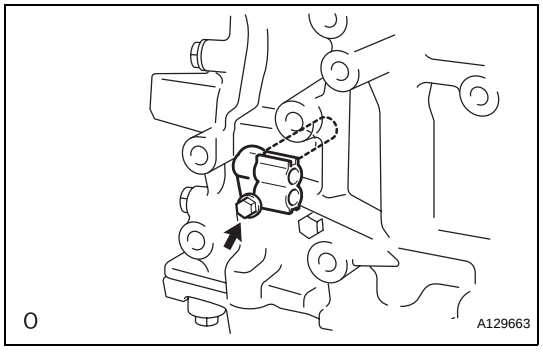


49. REMOVE NO. 2 STRAIGHT SCREW PLUG

(a) Using a 14 mm hexagon wrench, remove the 2 screw plugs and 2 gaskets.

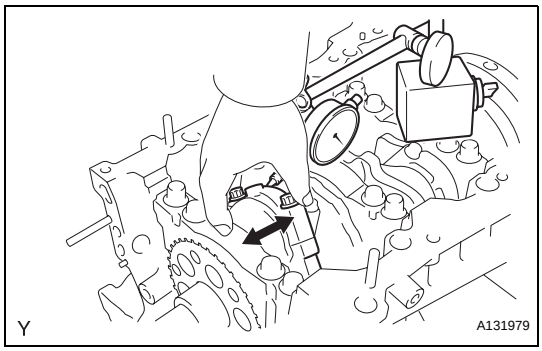
NOTICE:

If water leaks from the No. 2 screw plug or the plug is corroded, replace it.



50. REMOVE CRANKSHAFT POSITION SENSOR

(a) Remove the bolt and crankshaft position sensor.

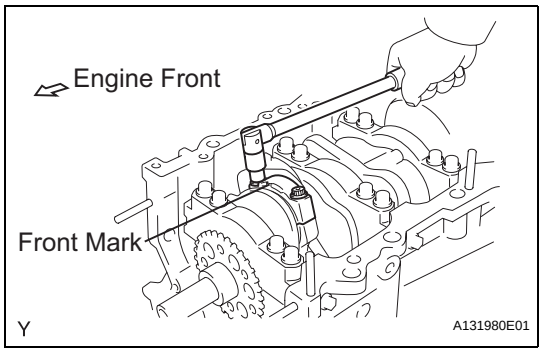


51. INSPECT CONNECTING ROD THRUST CLEARANCE

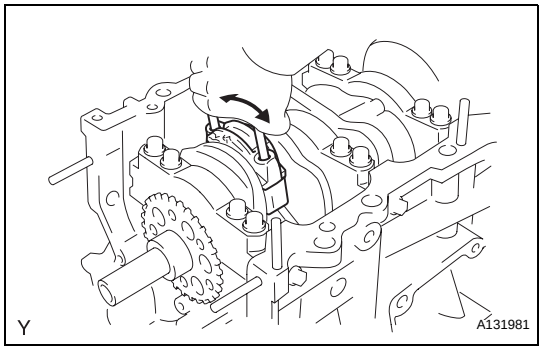
(a) Using a dial indicator, measure the thrust clearance while moving the connecting rod back and forth.
Standard thrust clearance:
0.15 to 0.40 mm (0.0059 to 0.0157 in.)
Maximum thrust clearance:
0.50 mm (0.0197 in.)
If the thrust clearance is greater than the maximum, replace one or more connecting rods as necessary.
If necessary, replace the crankshaft.

52. INSPECT CONNECTING ROD OIL CLEARANCE

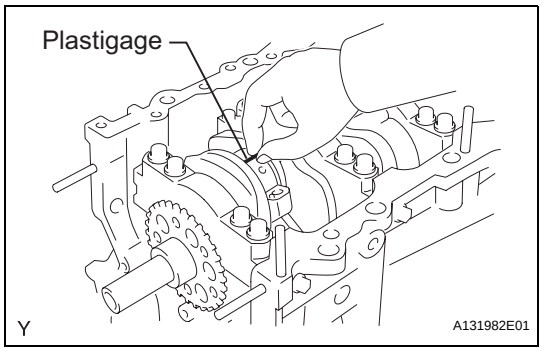
(a) Check that the front mark on the connecting rod and cap are aligned to ensure the correct reassembly.
NOTICE:
The front mark on the connecting rods and caps are for ensuring the correct reassembly.



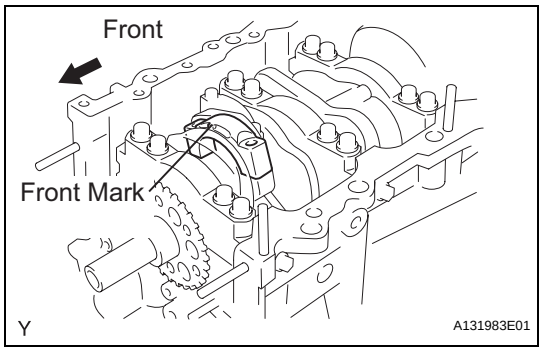
(b) Remove the 2 connecting rod cap bolts.



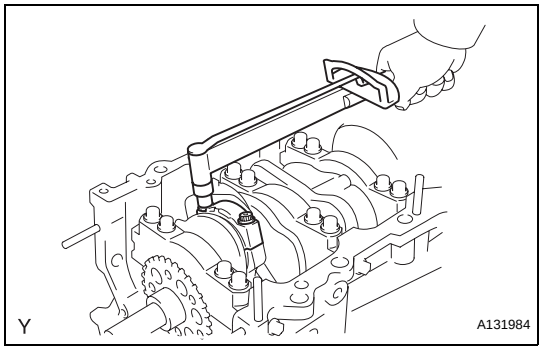
(c) Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.
HINT:
Keep the lower bearing inserted to the connecting rod cap.
(d) Clean the crank pin and bearing.
(e) Check the crank pin and bearing for pitting and scratches.



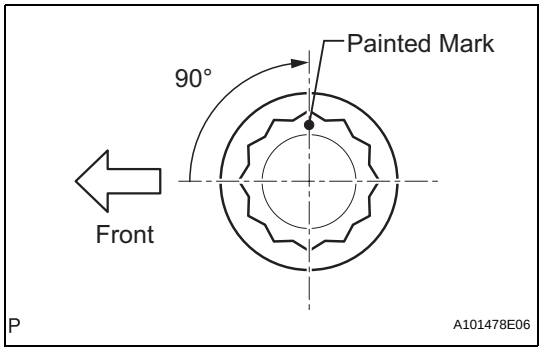
(f) Lay a strip of Plastigage on the crank pin.



(g) Check that the front mark of the connecting rod cap is facing forward.

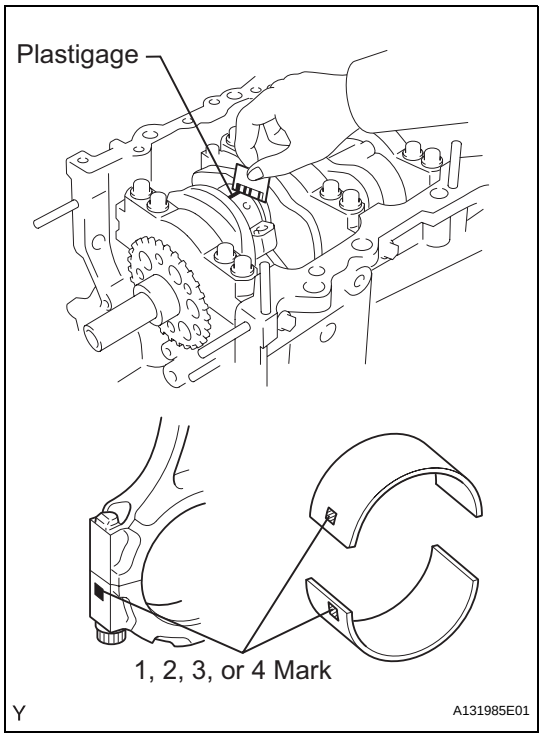


(h) Install and alternately tighten the bolts of the connecting rod cap in several steps.
NOTICE:
Do not turn the crankshaft.
Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)



(i) Mark the front side of each connecting cap bolt with paint.
(j) Retighten the cap bolts by 90° as shown.
(k) Check that the painted mark is now at a 90° angle to the front.
NOTICE:
Do not turn the crankshaft.
(l) Remove the 2 connecting rod cap bolts.
(m) Using the 2 removed connecting rod cap bolts, remove the connecting rod cap and lower bearing by wiggling the connecting rod cap right and left.
HINT:
Keep the lower bearing inserted to the connecting rod cap.

EM



(n) Measure the Plastigage at its widest point.
Standard oil clearance:
0.045 to 0.067 mm (0.0018 to 0.0026 in.)
Maximum oil clearance:
0.070 mm (0.0028 in.)
If the oil clearance is greater than the maximum, replace the bearings. If necessary, replace the crankshaft.
HINT:
If replacing a bearing, replace it with one that has the same number as its respective connecting rod cap. Each bearing's standard thickness is indicated by a 1, 2, 3 and 4 mark on its surface.
Reference:
Connecting rod big end inside diameter

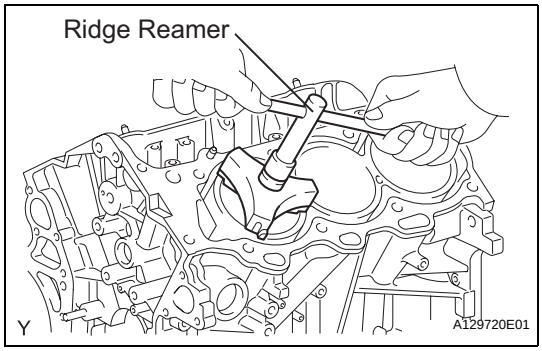
Mark	Thickness
1	56.000 to 56.006 mm (2.2047 to 2.2050 in.)
2	56.007 to 56.012 mm (2.2050 to 2.2052 in.)
3	56.013 to 56.018 mm (2.2052 to 2.2054 in.)
4	56.019 to 56.024 mm (2.2055 to 2.2057 in.)

Standard sized bearing center wall thickness

Mark	Thickness
1	1.481 to 1.484 mm (0.0583 to 0.0584 in.)
2	1.484 to 1.497 mm (0.0584 to 0.0585 in.)
3	1.487 to 1.490 mm (0.0585 to 0.0587 in.)
4	1.490 to 1.493 mm (0.0587 to 0.0588 in.)

Crankshaft pin diameter:
52.992 to 53.000 mm (2.0863 to 2.0866 in.)

(o) Completely remove the Plastigage.

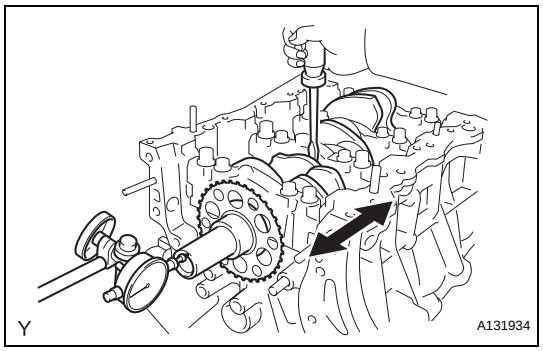


53. REMOVE PISTON SUB-ASSEMBLY WITH CONNECTING ROD

(a) Using a ridge reamer, remove all the carbon from the top of the cylinder.

(b) Push the piston, connecting rod and upper bearing through the top of the cylinder block.
HINT:
- Keep the bearing, connecting rod and cap together.
- Arrange the piston and connecting rod in the correct order.

54. REMOVE CONNECTING ROD BEARING
HINT:
Arrange the removed parts in the correct order.



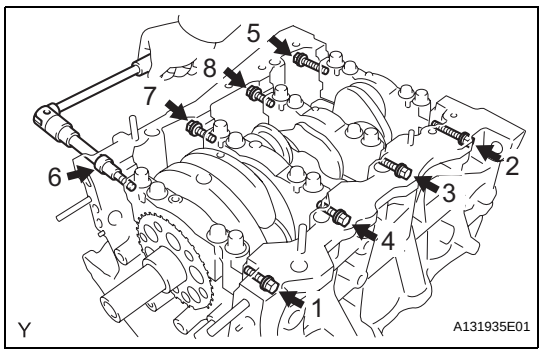
55. INSPECT CRANKSHAFT THRUST CLEARANCE

(a) Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

Standard thrust clearance:
0.04 to 0.24 mm (0.0016 to 0.0094 in.)
Maximum thrust clearance:
0.30 mm (0.0118 in.)

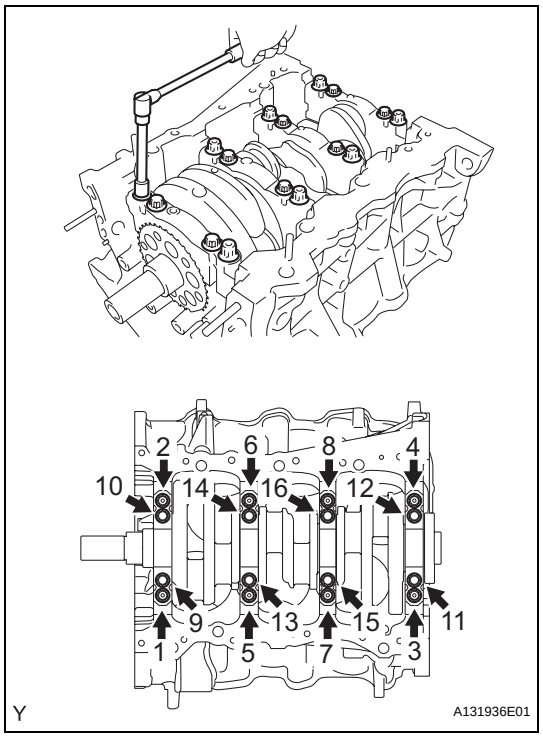
If the thrust clearance is greater than the maximum, replace the thrust washers as a set. If necessary, replace the crankshaft.

Standard thrust washer thickness:
2.43 to 2.48 mm (0.0957 to 0.0976 in.)

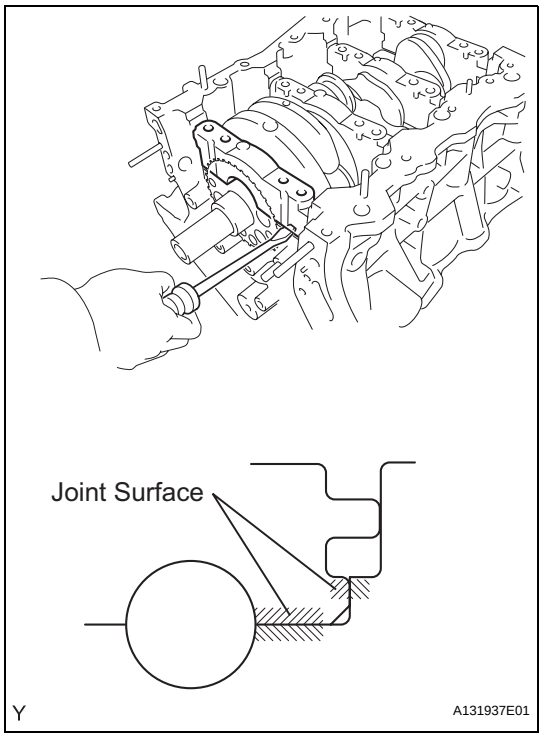


56. REMOVE CRANKSHAFT AND CRANKSHAFT OIL CLEARANCE

(a) Uniformly loosen and remove the 8 main bearing cap bolts and seal washers in several steps, in the sequence shown in the illustration.

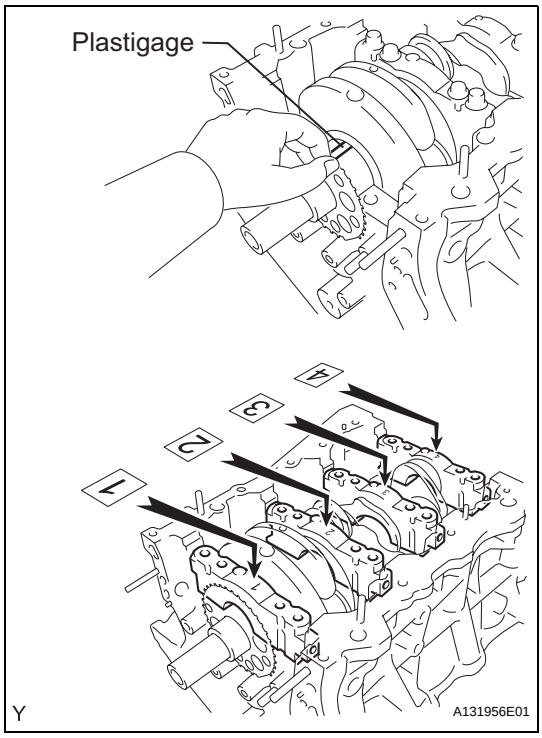


(b) Uniformly loosen the 16 bearing cap bolts in several steps, in the sequence shown in the illustration.

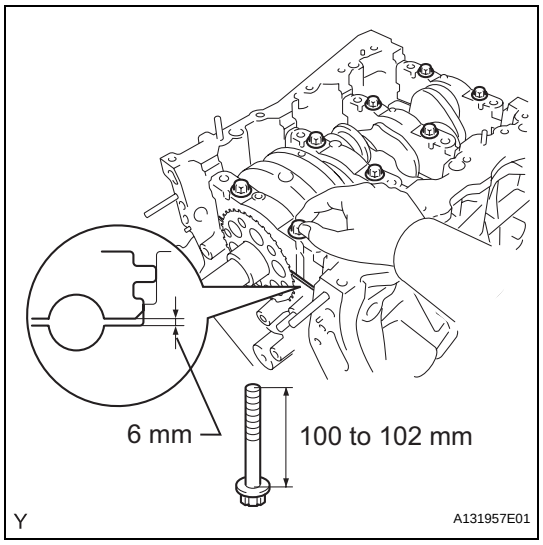


(c) Using a screwdriver, pry out the main bearing caps. Remove the 4 main bearing caps and lower bearings.
NOTICE:
- **Pry up the main cap little by little to the right and left in turns.**
- **Be careful not to damage the joint surface of the cylinder block and main bearing caps.**

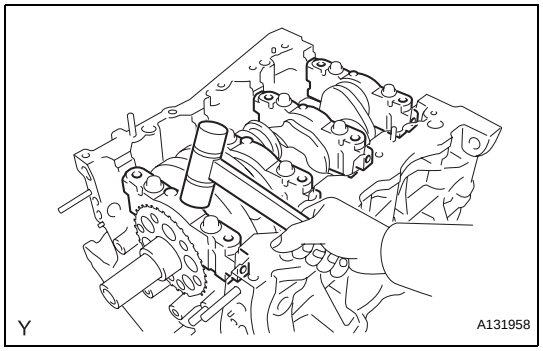
(d) Clean each main journal and bearing.
(e) Check each main journal and bearing for pitting and scratches.
HINT:
If the journal or bearing is damaged, replace the bearing.
(f) Place the crankshaft on the cylinder block.



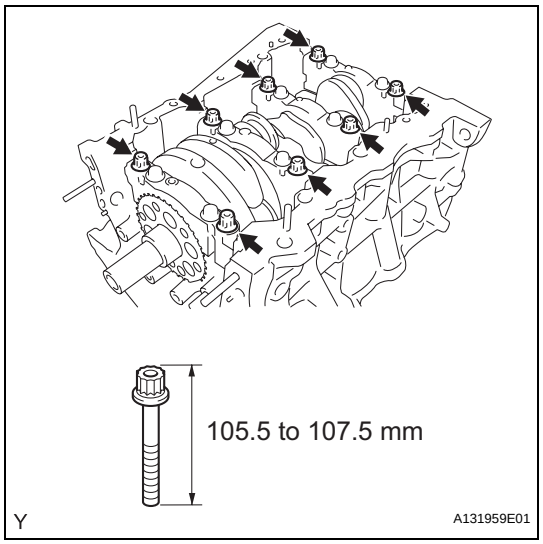
(g) Lay a strip of Plastigage across each journal.
(h) Examine the front marks and numbers and install the bearing caps on the cylinder block.
HINT:
A number is marked on each main bearing cap to indicate the installation position.
(i) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.
(j) Place the crankshaft bearing cap on the cylinder block.



(k) Install the main bearing cap with your hand until the clearance between the main bearing cap and the cylinder block is less than 6 mm (0.23 in.) by marking the 2 internal bearing cap bolts as a guide.
Bolt length:
100 to 102 mm (3.94 to 4.02 in.)

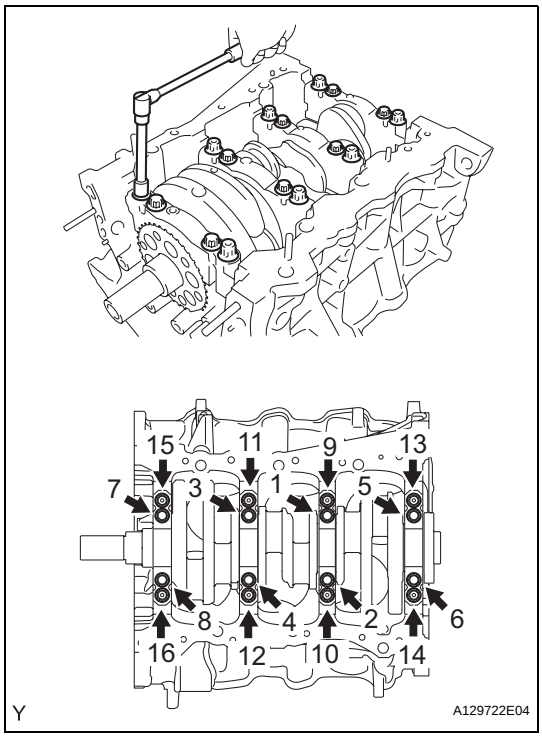


(l) Using a plastic-faced hammer, lightly tap the bearing cap to ensure a proper fit.
(m) Apply a light coat of engine oil on the threads and under the heads of the 8 main bearing cap bolts.



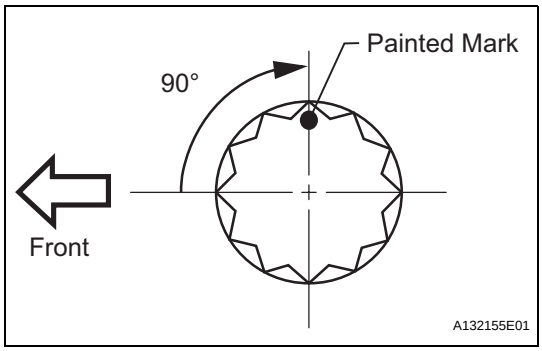
(n) Install the 8 main bearing cap bolts to the outside positions.
Bolt length:
105.5 to 107.5 mm (4.15 to 4.23 in.)
HINT:
The main bearing cap bolts are tightened in 2 progressive steps.

EM

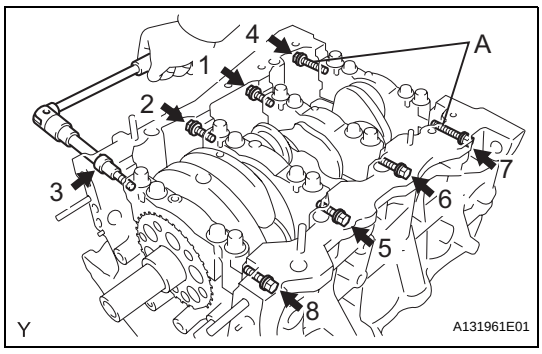


(o) Step 1
(1) Install and uniformly tighten the 16 main bearing cap bolts in the sequence shown in the illustration.
Torque: 61 N*m (622 kgf*cm, 45 ft.*lbf)
HINT:
If any of the main bearing cap bolts does not meet the torque specification, replace the main bearing cap bolt.
NOTICE:
Do not turn the crankshaft.

(p) Step 2
(1) Mark the front of the bearing cap bolts with paint.



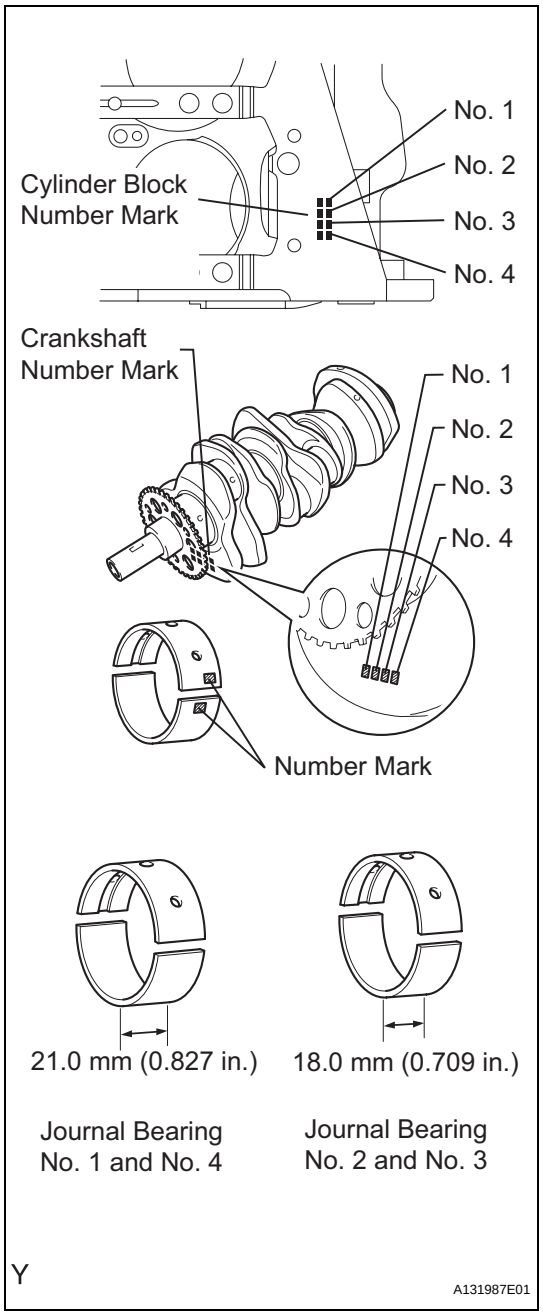
(2) Retighten the bearing cap bolts by 90° as shown in the order shown in step 1.
(3) Check that the painted mark is now at a 90° angle to the front.



(q) Install and uniformly tighten the 8 main bearing cap bolts in several steps and in the sequence shown in the illustration.
Torque: 52 N*m (530 kgf*cm, 38 ft.*lbf)
Bolt length:
45 mm (1.77 in.) for bolt A
30 mm (1.18 in.) for except bolt A

(r) Remove the 24 bolts and bearing cap bolts.

(s) Completely remove the Plastigage.



(t) If replacing a bearing, replace it with one having the same number. If the number of the bearing cannot be determined, select the correct bearing by adding together the numbers imprinted on the cylinder block and crankshaft, then refer to the table below for the appropriate bearing number. There are 5 sizes of standard bearings, marked "1", "2", "3", "4" and "5" accordingly.

Journal bearing

Use Bearing	Cylinder Block Number Mark + Crankshaft Number Mark
1	0 - 5
2	6 - 11
3	12 - 17
4	18 - 23
5	24 - 28

EXAMPLE:
Cylinder block "11" + Crankshaft "06" = Total number 17 (Use bearing "3")

EM

Standard crankshaft main journal diameter

Mark	Specified Condition
00	60.999 to 61.000 mm (2.4015 to 2.4016 in.)
01	60.998 to 60.999 mm (2.4015 to 2.4015 in.)
02	60.997 to 60.998 mm (2.4015 to 2.4015 in.)
03	60.996 to 60.997 mm (2.4014 to 2.4015 in.)
04	60.995 to 60.996 mm (2.4014 to 2.4014 in.)
05	60.994 to 60.995 mm (2.4013 to 2.4014 in.)
06	60.93 to 60.994 mm (2.4013 to 2.4013 in.)
07	60.992 to 60.993 mm (2.4013 to 2.4013 in.)
08	60.991 to 60.992 mm (2.4012 to 2.4013 in.)
09	60.990 to 60.991 mm (2.4012 to 2.4012 in.)
10	60.989 to 60.990 mm (2.4011 to 2.4012 in.)
11	60.988 to 60.989 mm (2.4.11 to 2.4011 in.)

Standard upper bearing center wall thickness No. 1 and No. 4 journal

Mark	Specified Condition
1	2.500 to 2.503 mm (0.0984 to 0.0985 in.)
2	2.503 to 2.506 mm (0.0985 to 0.0987 in.)
3	2.506 to 2.509 mm (0.0987 to 0.0988 in.)

Mark	Specified Condition
4	2.509 to 2.512 mm (0.0988 to 0.0989 in.)
5	2.512 to 2.515 mm (0.0989 to 0.0990 in.)

No. 2 and No. 3 journal

Mark	Specified Condition
1	2.478 to 2.481 mm (0.0976 to 0.0977 in.)
2	2.481 to 2.484 mm (0.0977 to 0.0978 in.)
3	2.484 to 2.487 mm (0.0978 to 0.0979 in.)
4	2.487to 2.490 mm (0.0979 to 0.0980 in.)
5	2.490 to 2.493 mm (0.0980 to 0.0981 in.)

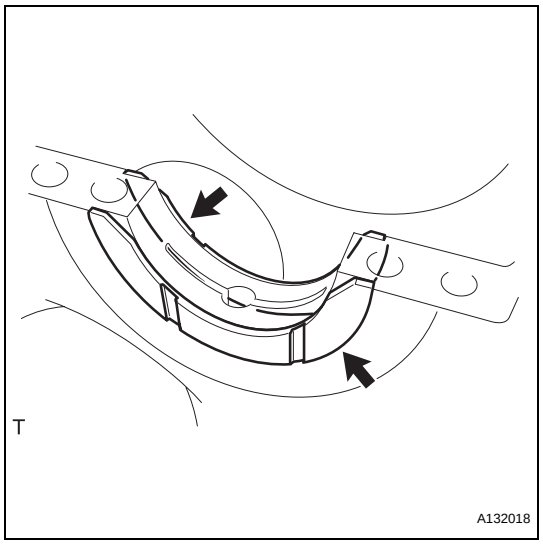
Standard lower bearing center wall thickness
No. 1 and No. 4 journal

Mark	Specified Condition
1	2.478 to 2.481 mm (0.0976 to 0.0977 in.)
2	2.481 to 2.484 mm (0.0977 to 0.0780 in.)
3	2.484 to 2.487 mm (0.0978 to 0.0979 in.)
4	2.487 to 2.490 mm (0.0979 to 0.0980 in.)
5	2.490 to 2.493 mm (0.0980 to 0.0981 in.)

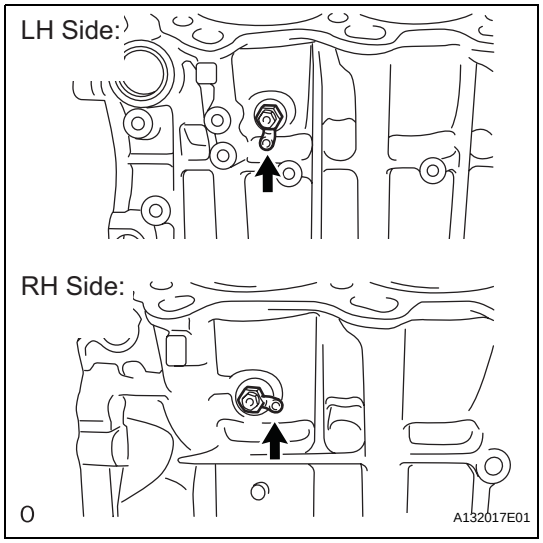
No. 2 and No. 3 journal

Mark	Specified Condition
1	2.500 to 2.503 mm (0.0984 to 0.0985 in.)
2	2.503 to 2.506 mm (0.0985 to 0.0987 in.)
3	2.506 to 2.509 mm (0.0987 to 0.0988 in.)
4	2.509 to 2.512 mm (0.0988 to 0.0989 in.)
5	2.512 to 2.515 mm (0.0989 to 0.0990 in.)

(u) Lift out the crankshaft.

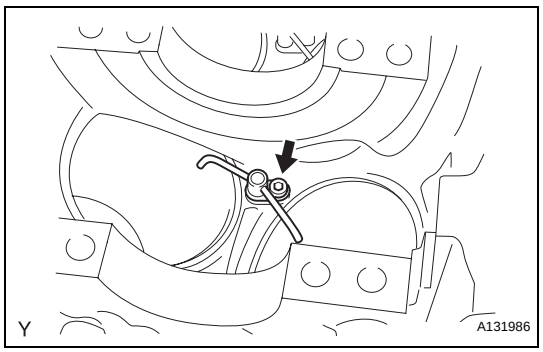


(v) Remove the upper bearings and upper thrust washers from the cylinder block.
HINT:
Arrange the bearings and thrust washers in the correct order.



57. REMOVE CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

(a) Remove the 2 water drain cocks from the cylinder block.
(b) Remove the water drain cock plugs from the water drain cocks.

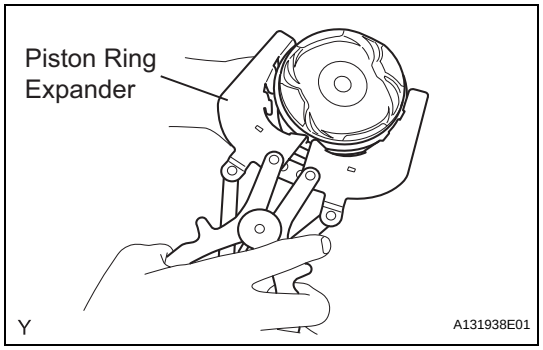


58. REMOVE NO. 1 OIL NOZZLE SUB-ASSEMBLY

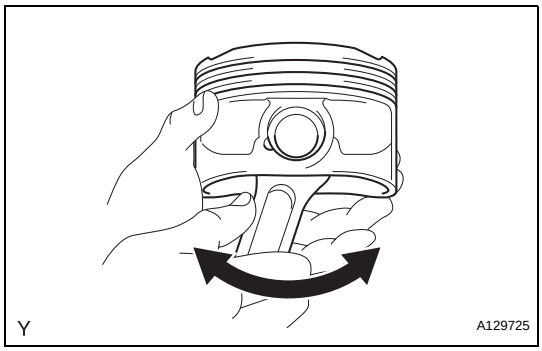
(a) Using a 5 mm hexagon wrench, remove the 3 oil nozzles.
(b) Check the oil nozzles for damage or clogging.
If necessary, replace the oil nozzle.

59. REMOVE PISTON RING SET

HINT:
Arrange the piston rings in the correct order.



(a) Using a piston ring expander, remove the 2 compression rings.
(b) Using a piston ring expander, remove the 2 side rails.
(c) Remove the oil ring expander by hand.



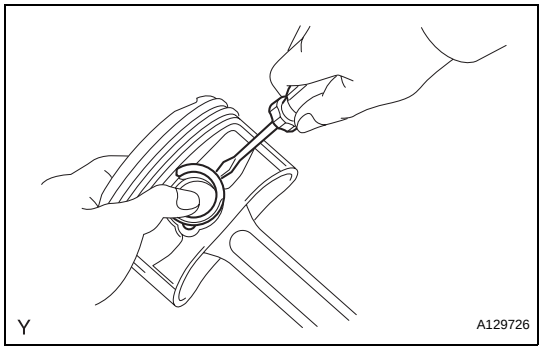
60. REMOVE PISTON WITH PIN SUB-ASSEMBLY

(a) Check the fitting condition between the piston and piston pin.

(1) Try to move the piston back and forth on the piston pin.

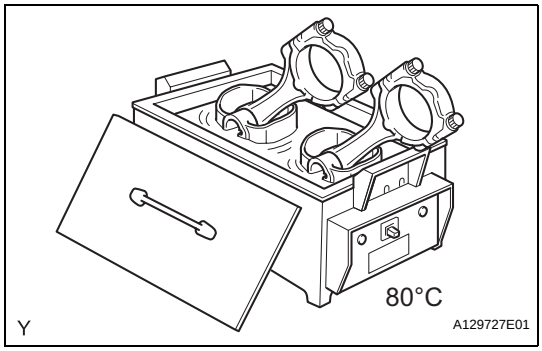
HINT:

If any movement is felt, replace the piston and pin as a set.

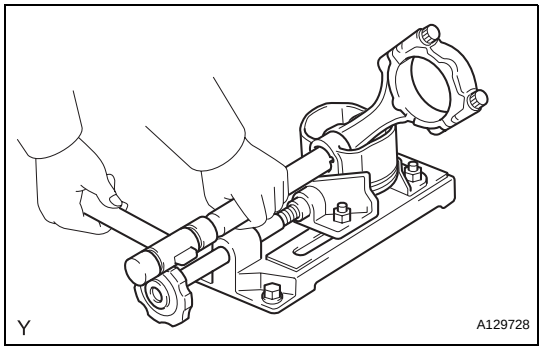


(b) Disconnect the connecting rod from the piston.

(1) Using a screwdriver, pry off the snap rings from the piston.



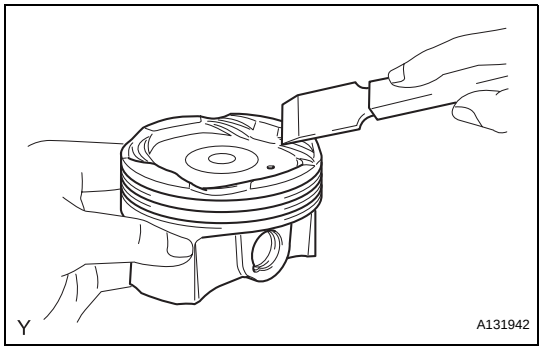
(2) Gradually heat the piston to approximately 80°C (176°F).



(3) Using a brass bar and plastic-faced hammer, lightly tap out the piston pin and remove the connecting rod.

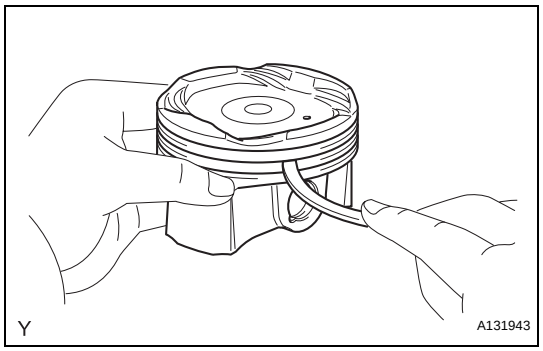
HINT:

- The piston and pin are a matched set.
- Arrange the pistons, pins, rings, connecting rods and bearings in the correct order.

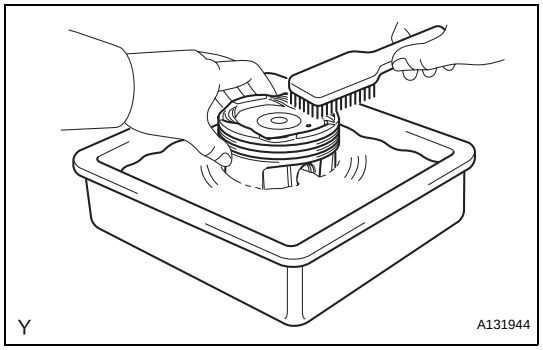


(c) Clean piston.

(1) Using a gasket scraper, remove the carbon from the piston top.



(2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.



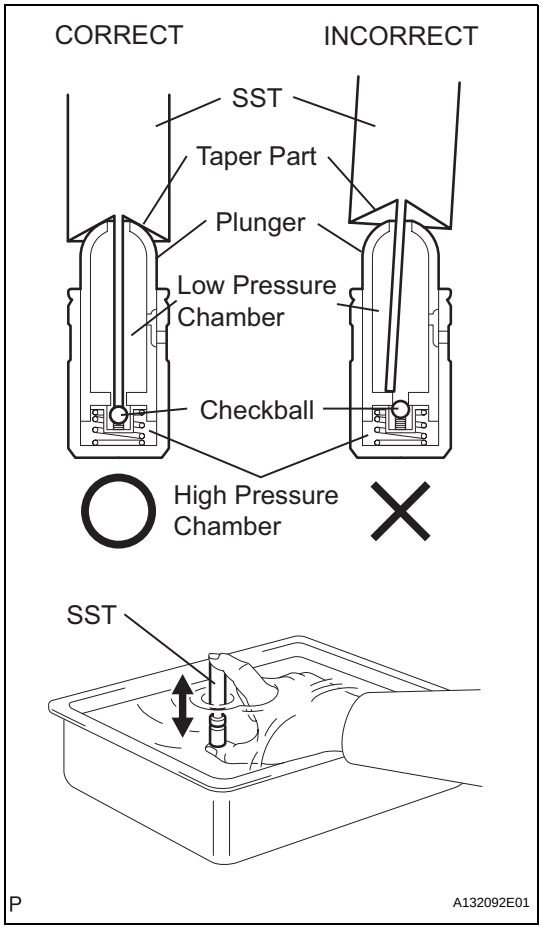
(3) Using solvent and a brush, thoroughly clean the piston.
NOTICE:
Do not use a wire brush.

INSPECTION

1. INSPECT VALVE LASH ADJUSTER ASSEMBLY

NOTICE:

- **Keep the lash adjuster free from dirt and foreign objects.**
- **Only use clean engine oil.**



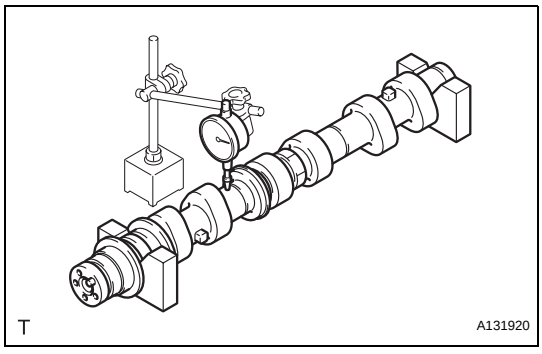
(a) Place the lash adjuster into a container full of engine oil.

(b) Insert the SST's tip into the lash adjuster's plunger and use the tip to press down on the checkball inside the plunger.
SST 09276-75010

(c) Squeeze the SST and lash adjuster together to move the plunger up and down 5 to 6 times.

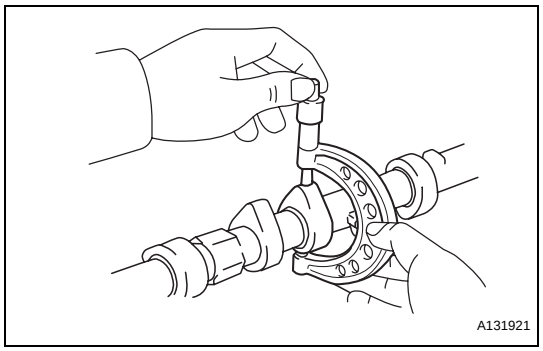
(d) Check the movement of the plunger and bleed the air.
OK:
Plunger moves up and down.
NOTICE:
When bleeding high-pressure air from the compression chamber, make sure that the tip of the SST is actually pressing the checkball as shown in the illustration. If the checkball is not pressed, air will not bleed.

(e) After bleeding the air, remove SST. Then try to quickly and firmly press the plunger with a finger.
OK:
Plunger is very difficult to move.
If the result is not as specified, replace the lash adjuster.



2. INSPECT CAMSHAFT

(a) Inspect the camshaft for runout.
(1) Place the camshaft on V-blocks.
(2) Using a dial indicator, measure the circle runout at the center journal.
Maximum circle runout:
0.04 mm (0.0016 in.)
If the circle runout is greater than the maximum, replace the camshaft.
HINT:
Check the oil clearance after replacing the camshaft.



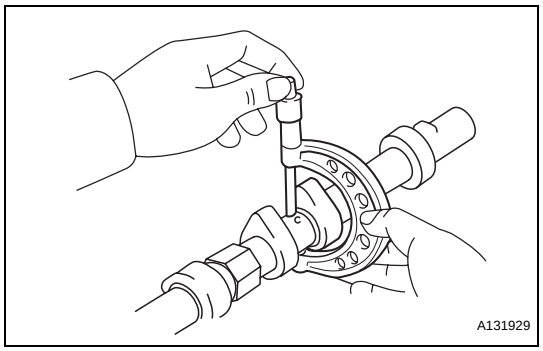
(b) Using a micrometer, measure the cam lobe height.
Standard cam lobe height

Item	Specified Condition
Intake	44.316 to 44.416 mm (1.7447 to 1.7487 in.)
Exhaust	44.262 to 44.362 mm (1.7426 to 1.7465 in.)

Maximum cam lobe height

Item	Specified Condition
Intake	44.166 mm (1.7388 in.)
Exhaust	44.112 mm (1.7367 in.)

If the cam lobe height is less than the minimum, replace the camshaft.



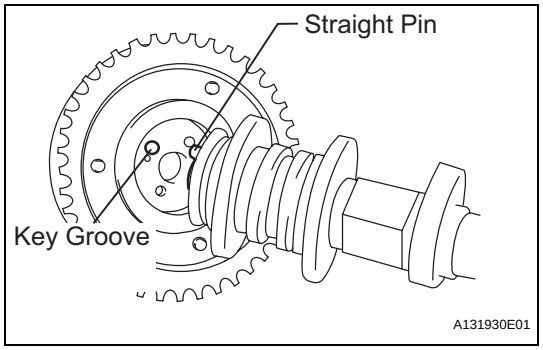
(c) Using a micrometer, measure the journal diameter.
Standard journal diameter

Item	Specified Condition
No. 1 journal	35.946 to 35.960 mm (1.4152 to 1.4157 in.)
Other journal	25.959 to 25.975 mm (1.0220 to 1.0226 in.)

If the journal diameter is not as specified, check the oil clearance.

3. INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

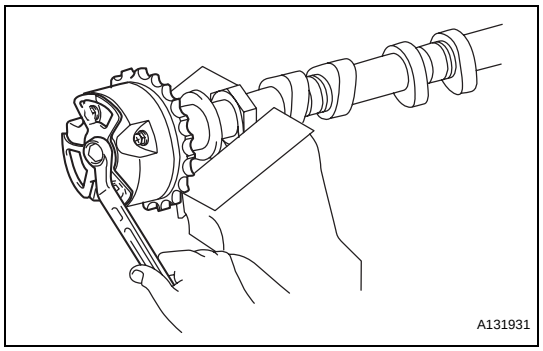
(a) Clamp the camshaft in a vise.
NOTICE:
Be careful not to damage the camshaft in the vise.



(b) Put the camshaft timing gear and camshaft together by aligning the key groove and straight pin.

(c) Lightly press the gear against the camshaft, and turn the gear. Push further at the position where the pin enters the groove.
NOTICE:
Be sure not to turn the camshaft timing gear in the retard direction (the right angle).

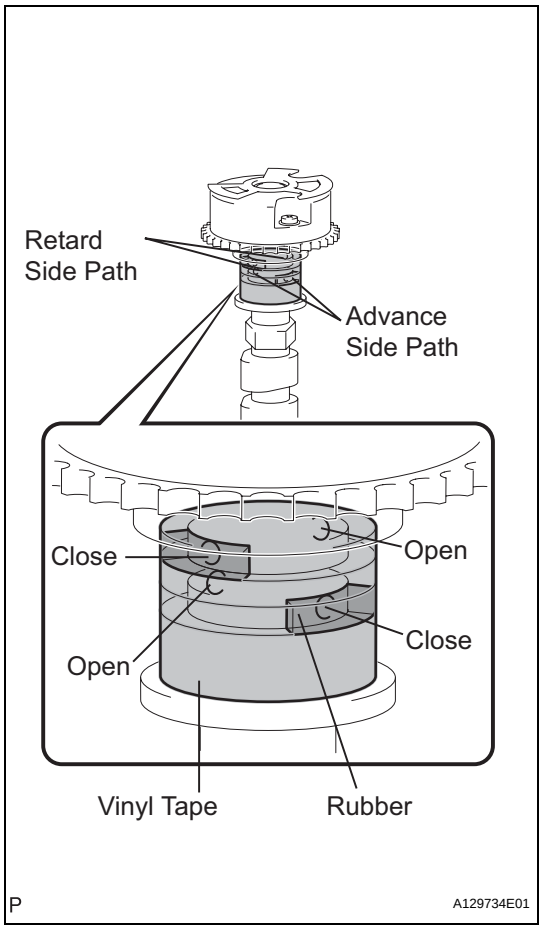
(d) Check that there is no clearance between the gear's fringe and the camshaft.



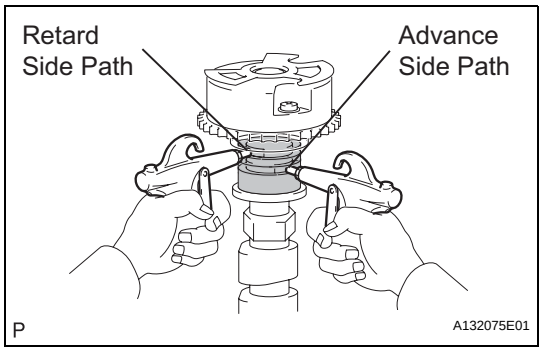
(e) Tighten the flange bolt with the camshaft timing gear fixed in place.
Torque: 100 N*m (1,020 kgf*cm, 74 ft.*lbf)

(f) Check the lock of the camshaft timing gear.
(1) Clamp the camshaft in a vise, and confirm that the camshaft timing gear is locked.
NOTICE:
Be careful not to damage the camshaft.

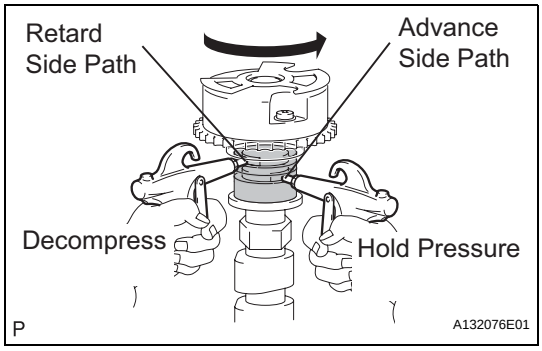
EM



(g) Release the lock pin.
(1) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.
HINT:
2 advance side paths are provided in the groove of the camshaft. Plug one of the paths with a rubber piece.
(2) Break through the tape of the advance side path and the retard side path on the opposite side to the hole of the advance side path, as shown in the illustration.



(3) Apply approximately 200 kPa (2.0 kgf/cm^2, 28 psi) of air pressure to the two broken paths.
CAUTION:
Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

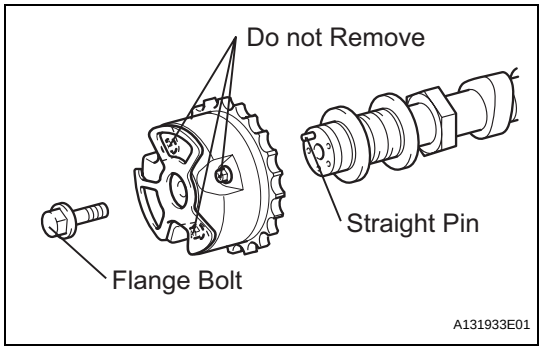


(4) Check that the camshaft timing gear revolves in the advance direction when reducing the air pressure applied to the retard side path.
HINT:
This operation releases the lock pin for the most retarded position.
(5) When the camshaft timing gear reaches the most advanced position, release the air pressure from the retard side path and advance side path, in that order.
NOTICE:
Do not release the air pressure from the advance side path first. The gear may abruptly shift in the retard direction and break the lock pin.

EM

(h) Check for smooth rotation.
(1) Turn the camshaft timing gear within its movable range (21°) 2 or 3 times, but do not turn it to the most retarded position. Make sure that the gear turns smoothly.
NOTICE:
Do not use air pressure to perform the smooth rotation check.

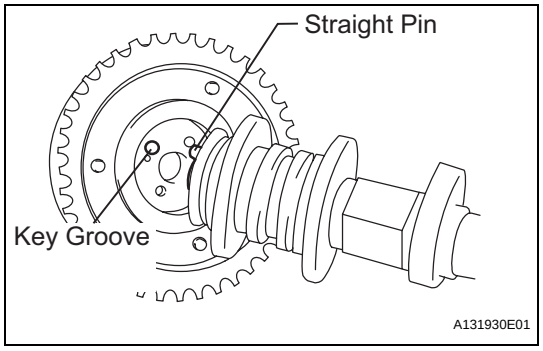
(i) Check the lock in the most retarded position.
(1) Confirm that the camshaft timing gear is locked at the most retarded position.



(j) Remove the flange bolt and camshaft timing gear.
NOTICE:
- **Be sure not to remove the other 3 bolts.**
- **If planning to reuse the gear, be sure to release the straight pin lock before installing the gear.**

4. INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

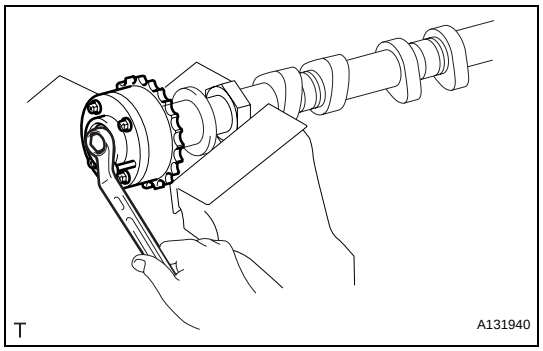
(a) Clamp the camshaft in a vise.
NOTICE:
Be careful not to damage the camshaft in the vise.



(b) Put the camshaft timing exhaust gear and camshaft together by aligning the key groove and straight pin.

(c) Lightly press the gear against the camshaft, and turn the gear. Push further at the position where the pin enters the groove.
CAUTION:
Be sure not to turn the camshaft timing exhaust gear in the retard direction (the right angle).

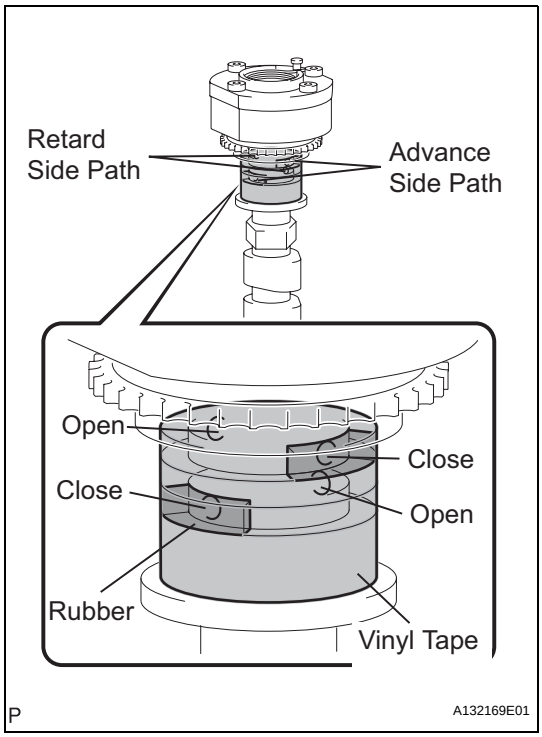
(d) Check that there is no clearance between the gear's fringe and the camshaft.



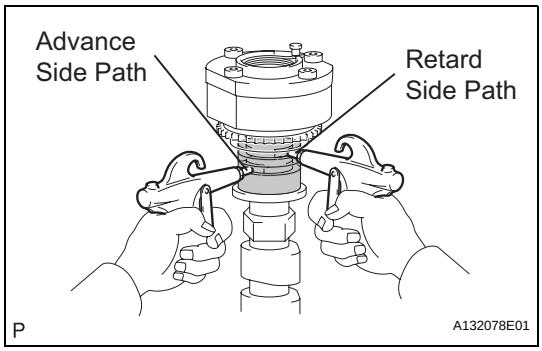
(e) Tighten the flange bolt with the camshaft timing exhaust gear fixed in place.
Torque: 100 N*m (1,020 kgf*cm, 74 ft.*lbf)

(f) Check the camshaft timing exhaust gear lock.
(1) Make sure that the camshaft timing exhaust gear is locked.

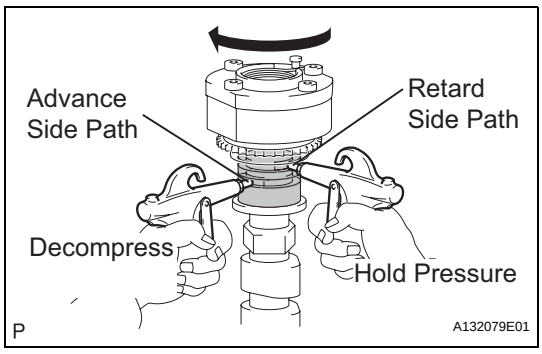
EM



(g) Release the lock pin.
(1) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.
HINT:
4 oil paths are provided in the groove. Plug 2 paths with rubber pieces.
(2) Prick a hole in the tape placed on the advance side path. Prick a hole in the tape placed on the retard side path on the opposite side to that of the advance side path, as shown in the illustration.



(3) Apply approximately 200 kPa (2.0 kgf/cm^2, 28 psi) of air pressure to the two broken paths (the advance side path and the retard side path).
CAUTION:
Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

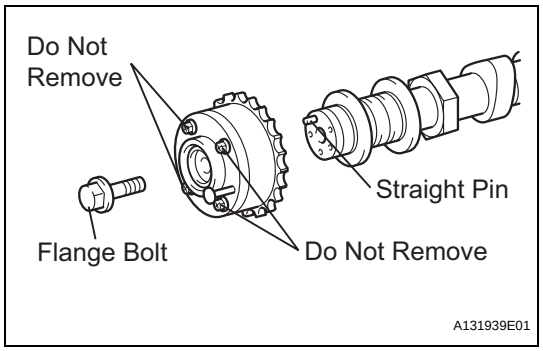


(4) Make sure that the camshaft timing exhaust gear turns in the retard direction when reducing the air pressure applied to the advance side path.
HINT:
The lock pin is released and the camshaft timing exhaust gear turns in the retard direction.
(5) When the camshaft timing exhaust gear moves to the most retarded position, release the air pressure from the advance side path, and then release the air pressure from the retard side path.
NOTICE:
Be sure to release the air pressure from the advance side path first. If the air pressure of the retard side path is released first, the camshaft timing exhaust gear may abruptly shift in the advance direction and break the lock pin or other parts.

EM

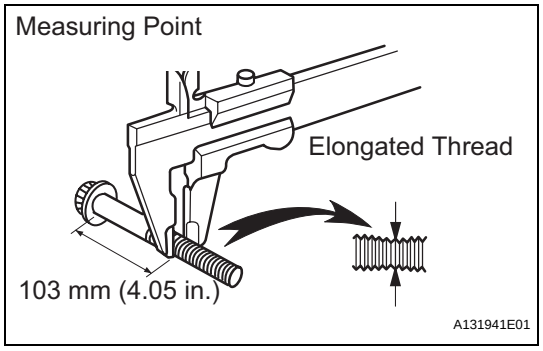
(h) Check for smooth rotation.
(1) Turn the camshaft timing exhaust gear within its movable range (18.5°) 2 or 3 times, but do not turn it to the most advanced position. Make sure that the gear turns smoothly.
NOTICE:
When the air pressure is released from the advance side path and then from the retard side path, the gear automatically returns to the most advanced position due to the advance assist spring operation and locks. Gradually release the air pressure from the retard side path before performing the smooth rotation check.

(i) Check the lock at the most advanced position.
(1) Make sure that the camshaft timing exhaust gear is locked at the most advanced position.



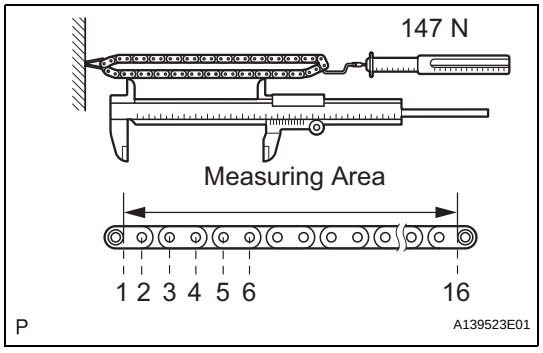
(j) Remove the flange bolt and camshaft timing exhaust gear.
NOTICE:
- **Be sure not to remove the other 3 bolts.**
- **If planning to reuse the gear, be sure to release the straight pin lock before installing the gear.**

EM



5. INSPECT CYLINDER HEAD SET BOLT

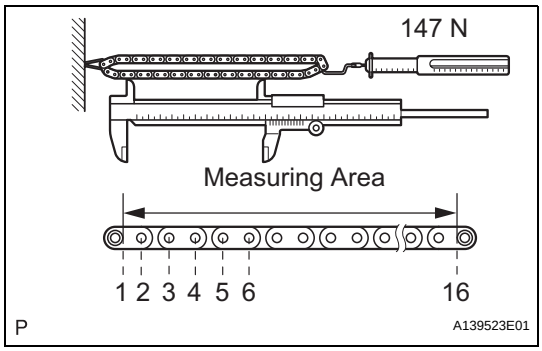
(a) Using a vernier caliper, measure the minimum diameter of the elongated thread at the measuring point.
Minimum outside diameter:
10.70 mm (0.4213 in.)
HINT:
- If a visual check reveals no excessively thin areas, check the center of the bolt (see illustration) and find the area that has the lowest diameter.
- If the diameter is less than the minimum, replace the cylinder head bolt.



6. INSPECT CHAIN SUB-ASSEMBLY

(a) Using a spring scale, pull the chain with a force of 147 N (15 kgf, 33 lbf) as shown in the illustration.

(b) Using a vernier caliper, measure the length of 16 links.
Maximum chain elongation:
136.9 mm (5.389 in.)
If the elongation is greater than the maximum, replace the chain.
NOTICE:
Perform the measurement at 3 random places. Inspect using the average of the measurements.



7. INSPECT NO. 2 CHAIN SUB-ASSEMBLY

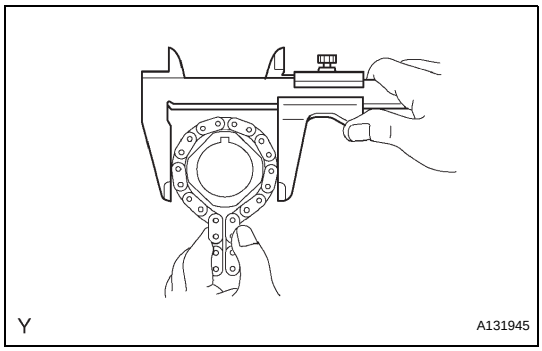
(a) Pull the chain with a force of 147 N (15 kgf, 33 lbf) as shown in the illustration.

(b) Using a vernier caliper, measure the length of 16 links.

Maximum chain elongation:
137.6 mm (5.417 in.)

If the elongation is greater than the maximum, replace the chain.

NOTICE:
Perform the measurement at 3 random places.
Inspect using the average of the measurements.



8. INSPECT CRANKSHAFT TIMING GEAR OR SPROCKET

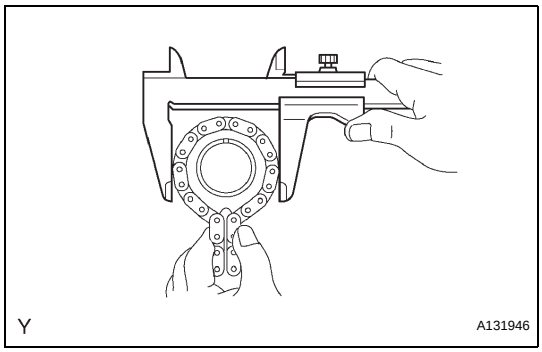
(a) Wrap the chain around the sprocket.

(b) Using a vernier caliper, measure the sprocket diameter with the chain.

Minimum sprocket diameter (w/ chain):
61.4 mm (2.417 in.)

HINT:

- The vernier caliper must contact the chain rollers for the measurement.
- If the diameter is less than the minimum, replace the chain and sprocket.



9. INSPECT IDLE SPROCKET ASSEMBLY

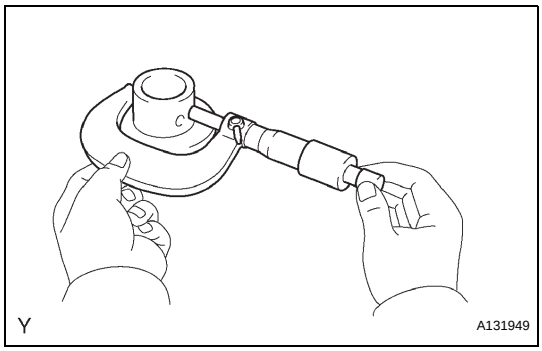
(a) Wrap the chain around the sprocket.

(b) Using a vernier caliper, measure the sprocket diameter with the chain.

Minimum sprocket diameter (w/ chain):
61.4 mm (2.417 in.)

HINT:

- The vernier caliper must contact the chain rollers for the measurement.
- If the diameter is less than the minimum, replace the chain and sprocket.

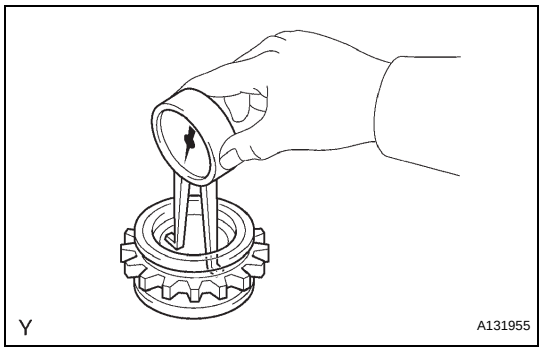


10. INSPECT IDLE GEAR SHAFT OIL CLEARANCE

(a) Using a micrometer, measure the idle gear shaft diameter.

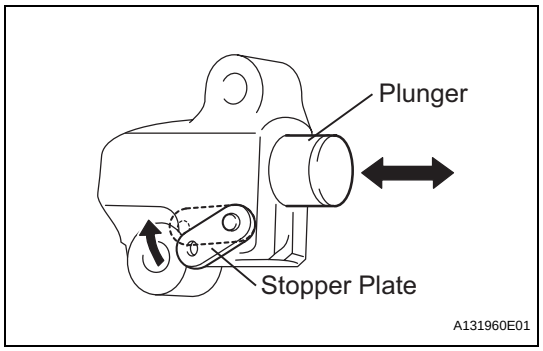
Standard idle gear shaft diameter:
22.987 to 23.000 mm (0.9050 to 0.9055 in.)

EM



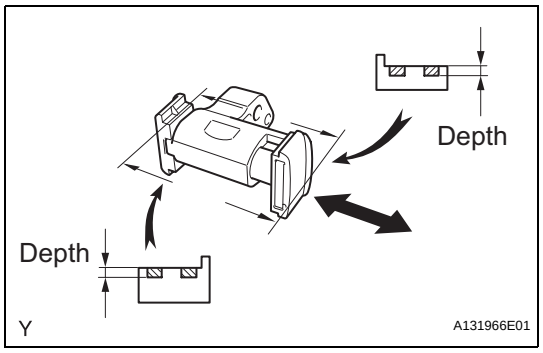
(b) Using a caliper gauge, measure the inside diameter of the idle gear.
Standard idle gear inside diameter:
23.02 to 23.03 mm (0.9062 to 0.9067 in.)

(c) Subtract the idle gear shaft diameter measurement from the idle gear inside diameter measurement.
Standard oil clearance:
0.02 to 0.043 mm (0.0001 to 0.0017 in.)
Maximum oil clearance:
0.043 mm (0.0017 in.)
If the thrust oil clearance is greater than the maximum, replace the idle gear shaft and idle gear.



11. INSPECT NO. 1 CHAIN TENSIONER ASSEMBLY

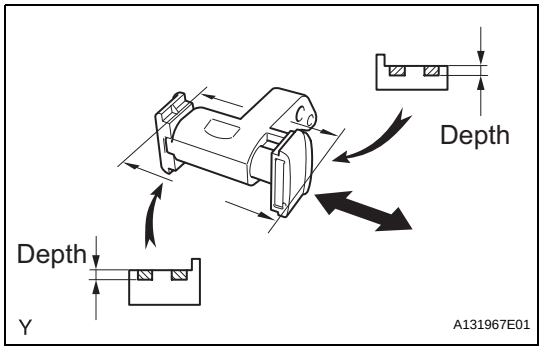
(a) Move the stopper plate upward to release the lock. Push the plunger and check that it moves smoothly. If necessary, replace the chain tensioner.



12. INSPECT NO. 2 CHAIN TENSIONER ASSEMBLY

(a) Check that the plunger moves smoothly.

(b) Measure the worn depth of the chain tensioner.
Maximum depth:
0.9 mm (0.035 in.)
If the depth is greater than the maximum, replace the chain tensioner.

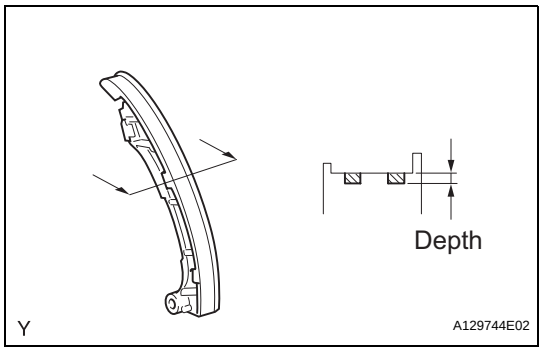


13. INSPECT NO. 3 CHAIN TENSIONER ASSEMBLY

(a) Check that the plunger moves smoothly.

(b) Measure the worn depth of the chain tensioner.
Maximum depth:
0.9 mm (0.035 in.)
If the depth is greater than the maximum, replace the chain tensioner.

EM



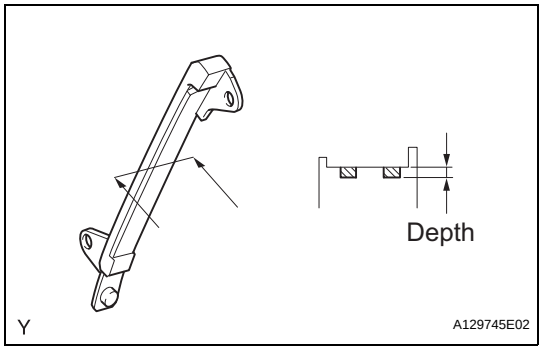
14. INSPECT CHAIN TENSIONER SLIPPER

(a) Measure the worn depth of the chain tensioner slipper.

Maximum depth:

1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the chain tensioner slipper.



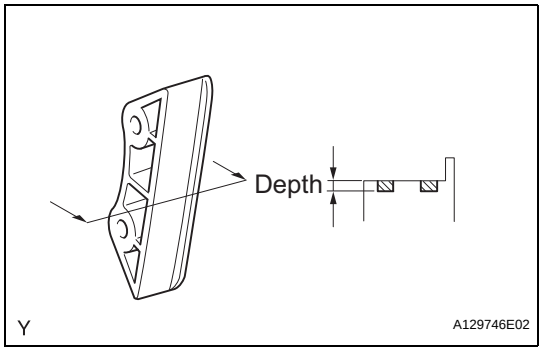
15. INSPECT NO. 1 CHAIN VIBRATION DAMPER

(a) Measure the worn depth of the chain vibration damper.

Maximum depth:

1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the chain vibration damper.



16. INSPECT NO. 2 CHAIN VIBRATION DAMPER

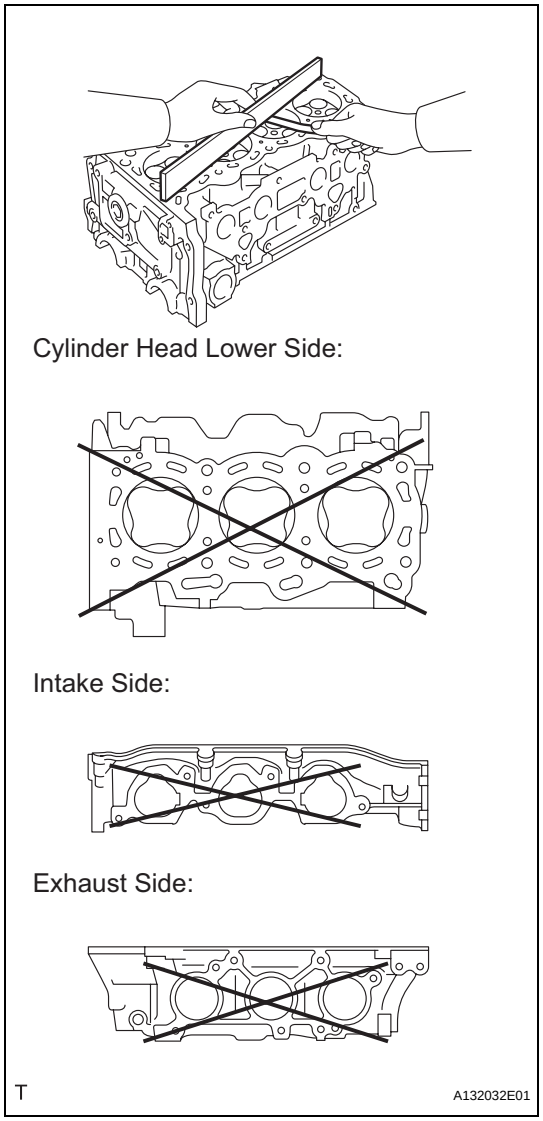
(a) Measure the worn depth of the chain vibration damper.

Maximum depth:

1.0 mm (0.039 in.)

If the depth is greater than the maximum, replace the chain vibration damper.

EM



17. INSPECT CYLINDER HEAD SUB-ASSEMBLY

(a) Using a precision straightedge and feeler gauge, measure the warpage of the contact surface of the cylinder block and manifolds.

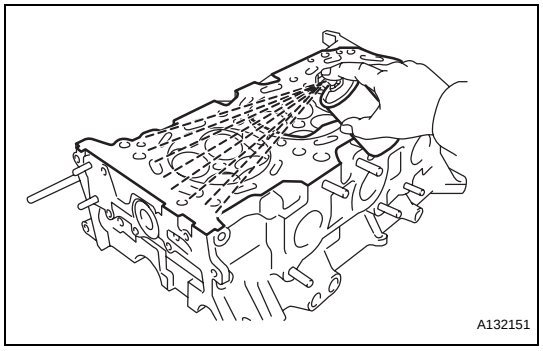
Standard warpage

Item	Specified Condition
Cylinder head lower side	0.05 mm (0.0020 in.)
Intake side	0.08 mm (0.0031 in.)
Exhaust side	0.08 mm (0.0031 in.)

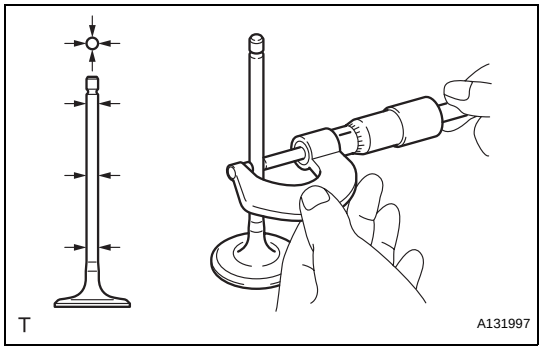
Maximum warpage:
0.10 mm (0.0039 in.)

If the warpage is greater than the maximum, replace the cylinder head.

EM



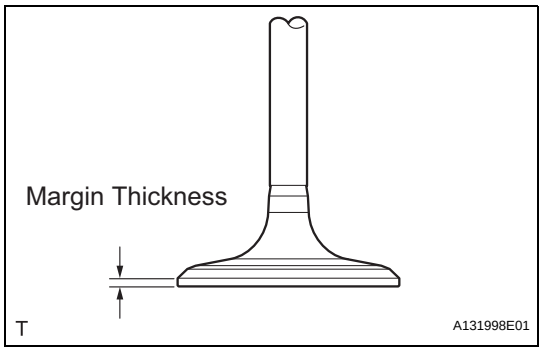
(b) Using a dye penetrate, check the intake ports, exhaust ports and cylinder surface for cracks.
If cracked, replace the cylinder head.



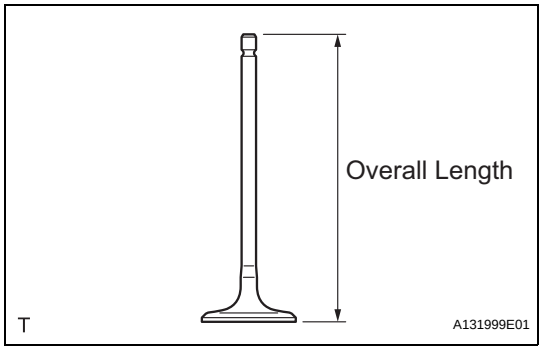
18. INSPECT INTAKE VALVE

(a) Using a micrometer, measure the diameter of the valve stem.

Standard valve stem diameter:
5.470 to 5.485 mm (0.2154 to 0.2159 in.)

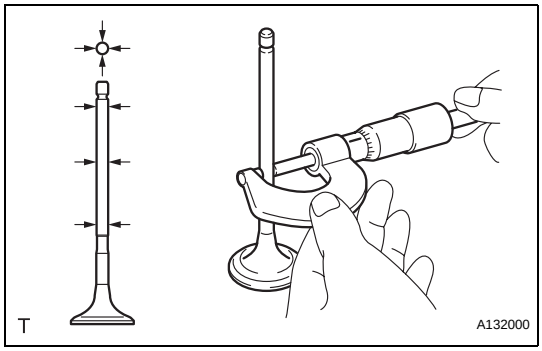


(b) Using a vernier caliper, measure the valve head margin thickness.
Standard margin thickness:
1.0 mm (0.0394 in.)
Minimum margin thickness:
0.50 mm (0.0197 in.)
If the margin thickness is less than the minimum, replace the intake valve.



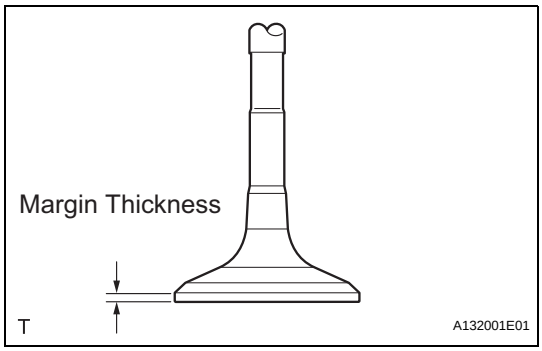
(c) Using a vernier caliper, measure the valve's overall length.
Standard overall length:
105.85 mm (4.1673 in.)
Minimum overall length:
105.35 mm (4.1476 in.)
If the overall length is less than the minimum, replace the intake valve.

EM

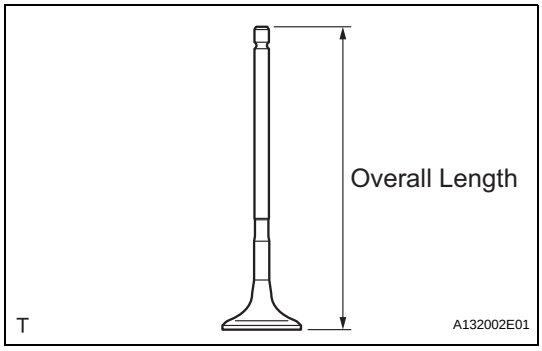


19. INSPECT EXHAUST VALVE

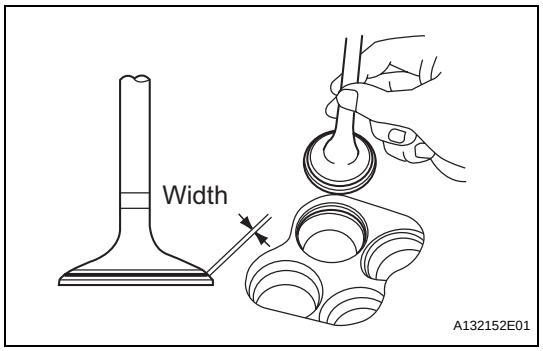
(a) Using a micrometer, measure the diameter of the valve stem.
Standard valve stem diameter:
5.465 to 5.480 mm (0.2151 to 0.2157 in.)



(b) Using a vernier caliper, measure the valve head margin thickness.
Standard margin thickness:
1.0 mm (0.0394 in.)
Minimum margin thickness:
0.50 mm (0.0197 in.)
If the margin thickness is less than the minimum, replace the exhaust valve.

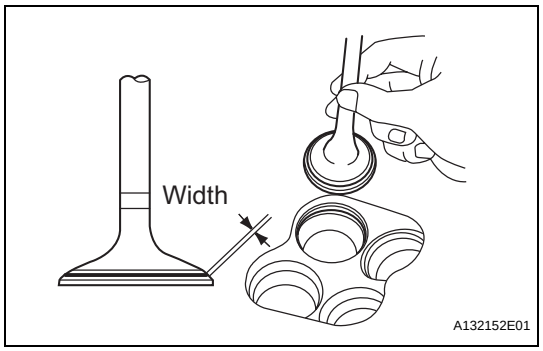


(c) Using a vernier caliper, measure the valve's overall length.
Standard overall length:
110.40 mm (4.3464 in.)
Minimum overall length:
109.90 mm (4.3268 in.)
If the overall length is less than the minimum, replace the exhaust valve.



20. INSPECT INTAKE VALVE SEAT

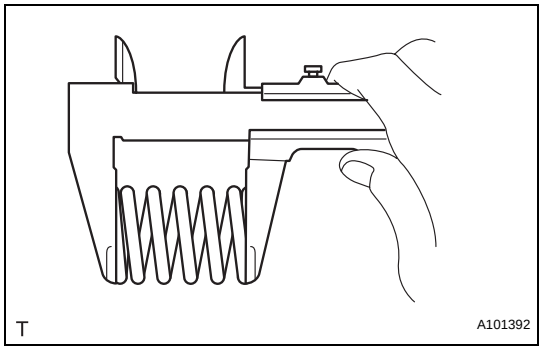
(a) Apply a light coat of Prussian blue to the valve face.
(b) Lightly press the valve face against the valve seat.
(c) Check the valve face and valve seat by using the following procedure.
  (1) If Prussian blue appears around the entire valve face, the valve face is concentric. If not, replace the valve.
  (2) If Prussian blue appears around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.
  (3) Check that the valve seat contacts in the middle of the valve face with the width between 1.1 and 1.5 mm (0.043 and 0.059 in.).



21. INSPECT EXHAUST VALVE SEAT

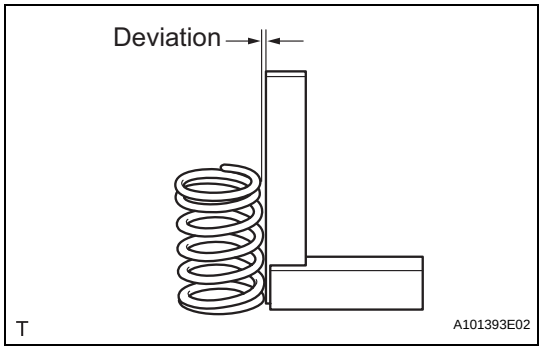
(a) Apply a light coat of Prussian blue to the valve face.
(b) Lightly press the valve face against the valve seat.
(c) Check the valve face and valve seat by using the following procedure.
  (1) If Prussian blue appears around the entire valve face, the valve face is concentric. If not, replace the valve.
  (2) If Prussian blue appears around the entire valve seat, the guide and valve face are concentric. If not, resurface the valve seat.
  (3) Check that the valve seat contacts in the middle of the valve face with the width between 1.2 and 1.6 mm (0.047 and 0.063 in.).

EM

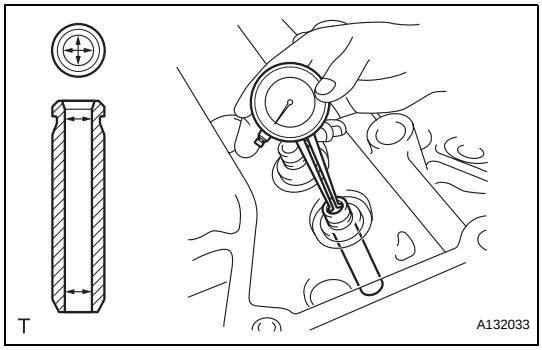


22. INSPECT INNER COMPRESSION SPRING

(a) Using a vernier caliper, measure the free length of the inner compression spring.
Standard free length:
45.46 mm (1.7898 in.)
If the free length is not as specified, replace the spring.



(b) Using a steel square, measure the deviation of the inner compression spring.
Maximum deviation:
1.0 mm (0.039 in.)
Maximum angle (reference):
2°
If the deviation is greater than the maximum, replace the spring.



23. INSPECT VALVE GUIDE BUSH OIL CLEARANCE

(a) Using a caliper gauge, measure the inside diameter of the guide bush.

Standard bush inside diameter:
5.51 to 5.53 mm (0.2169 to 0.2177 in.)

(b) Subtract the valve stem diameter measurement from the guide bush inside diameter measurement.

Standard clearance

Item	Specified Condition
Intake	0.025 to 0.060 m (0.0010 to 0.0024 in.)
Exhaust	0.030 to 0.065 mm (0.0012 to 0.0026 in.)

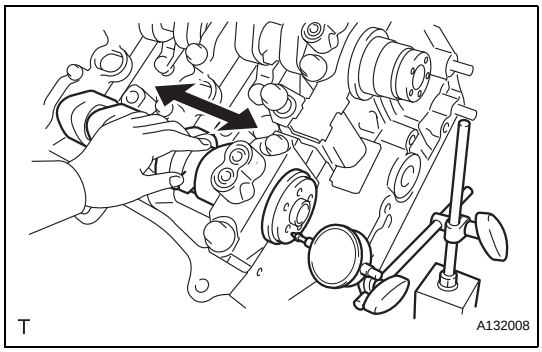
Maximum oil clearance

Item	Specified Condition
Intake	0.08 mm (0.0031 in.)
Exhaust	0.10 mm (0.0039 in.)

HINT:

- If the clearance is greater than the maximum, replace the intake valve and intake guide bush.
- If the clearance is greater than the maximum, replace the exhaust valve and exhaust guide bush.

EM



24. INSPECT CAMSHAFT THRUST CLEARANCE

(a) Inspect the bank 1 camshafts.

(1) Install the bank 1 camshafts.

(2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:
0.08 to 0.13 mm (0.0031 to 0.0051 in.)
Maximum thrust clearance:
0.15 mm (0.006 in.)

If the thrust clearance is greater than the maximum, replace the cylinder head. If the thrust surface is damaged, replace the camshaft.

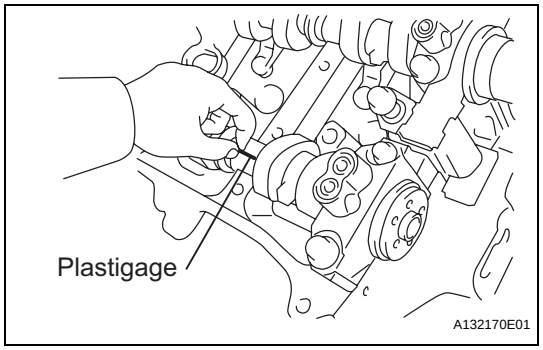
(b) Inspect the bank 2 camshafts.

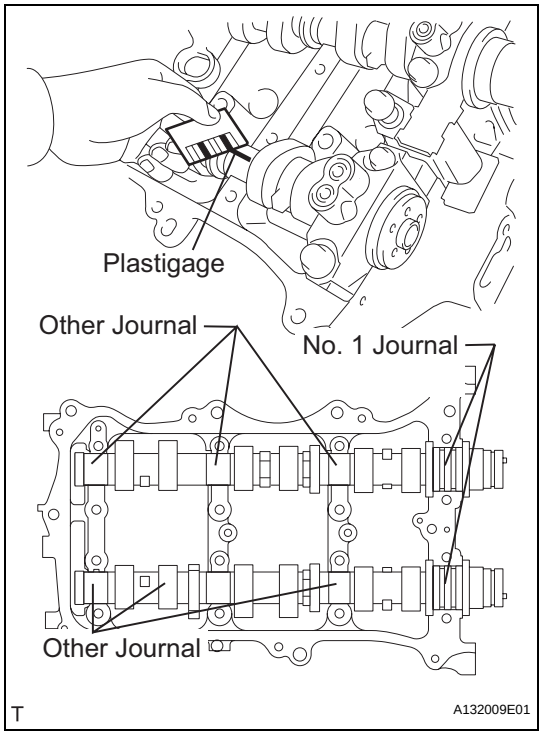
(1) Install the bank 2 camshafts.

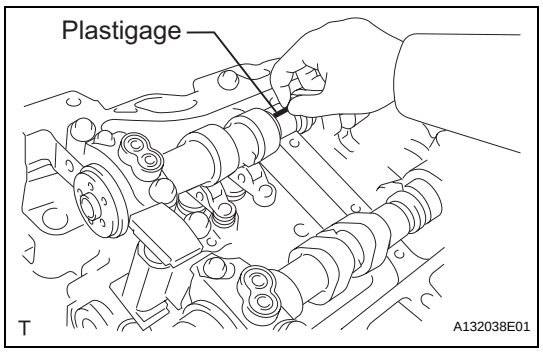
(2) Using a dial indicator, measure the thrust clearance while moving the camshaft back and forth.

Standard thrust clearance:
0.08 to 0.13 mm (0.0031 to 0.0051 in.)
Maximum thrust clearance:
0.15 mm (0.006 in.)

If the thrust clearance is greater than the maximum, replace the cylinder head. If the thrust surface is damaged, replace the camshaft.







25. INSPECT CAMSHAFT OIL CLEARANCE

(a) Clean the bearing caps, camshaft housing and camshaft journals.
(b) Place the camshafts on the camshaft housing.
(c) Lay a strip of Plastigage across each of the camshaft journals.
(d) Install the bearing caps.
NOTICE:
Do not turn the camshaft.
(e) Remove the bearing caps.

(f) Measure the Plastigage at its widest point.
Standard oil clearance

Item	Specified Condition
No. 1 journal	0.040 to 0.079 mm (0.0016 to 0.0031 in.)
Other journal	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

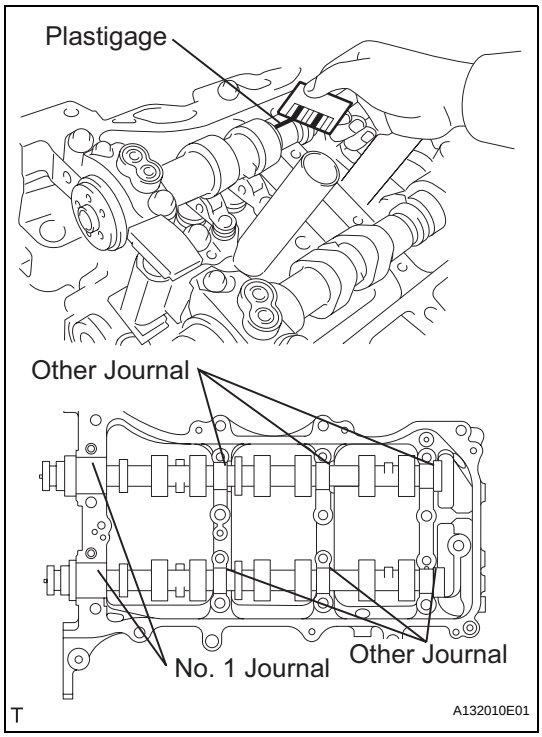
Maximum oil clearance

Item	Specified Condition
No. 1 journal	0.10 mm (0.0039 in.)
Other journal	0.09 mm (0.0035 in.)

If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the camshaft housing.
(g) Clean the bearing caps, camshaft housing and camshaft journals.
(h) Place the camshafts on the camshaft housing.

(i) Lay a strip of Plastigage across each of the camshaft journals.
(j) Install the bearing caps.
NOTICE:
Do not turn the camshaft.
(k) Remove the bearing caps.

EM



(l) Measure the Plastigage at its widest point.
Standard oil clearance

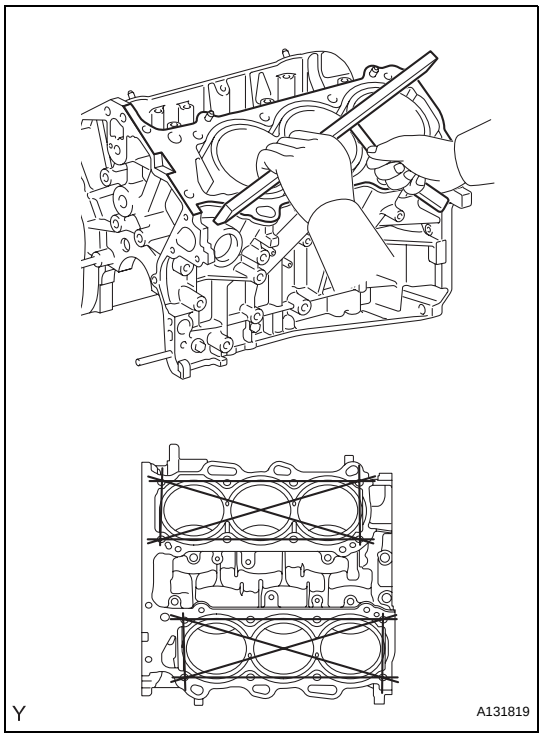
Item	Specified Condition
No. 1 journal	0.040 to 0.079 mm (0.0016 to 0.0031 in.)
Other journal	0.025 to 0.062 mm (0.0010 to 0.0024 in.)

Maximum oil clearance

Item	Specified Condition
No. 1 journal	0.10 mm (0.0039 in.)
Other journal	0.09 mm (0.0035 in.)

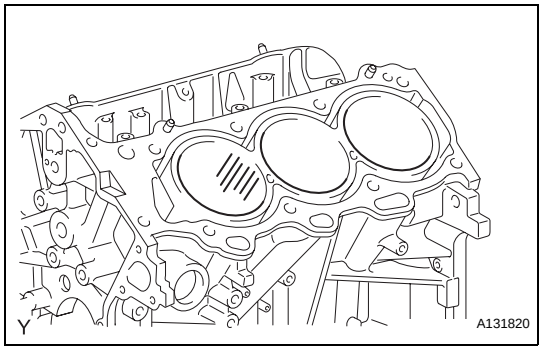
If the oil clearance is greater than the maximum, replace the camshaft. If necessary, replace the camshaft housing.

EM

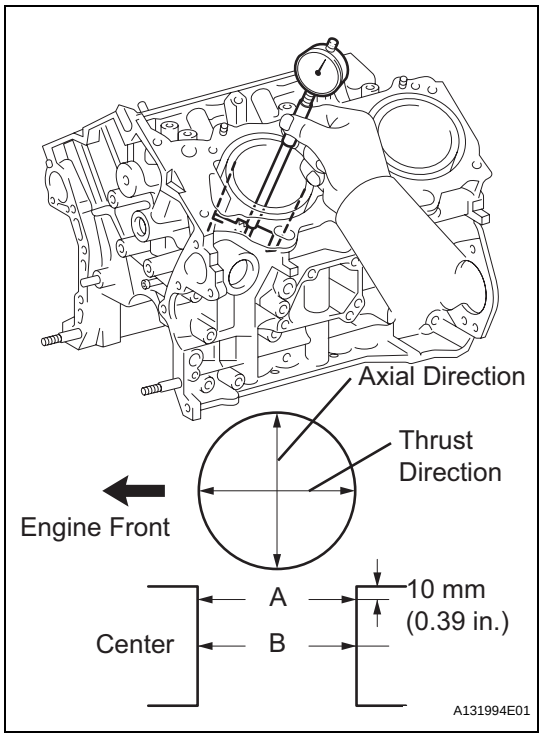


26. INSPECT CYLINDER BLOCK FOR WARPAGE

(a) Using a precision straightedge and feeler gauge, measure the warpage of the contact surface of the cylinder head gasket.
Maximum warpage:
0.07 mm (0.0028 in.)
If the warpage is greater than the maximum, replace the cylinder block.



(b) Visually check the cylinder for vertical scratches.
If deep scratches are present, rebore all 6 cylinders.
If necessary, replace the cylinder block.

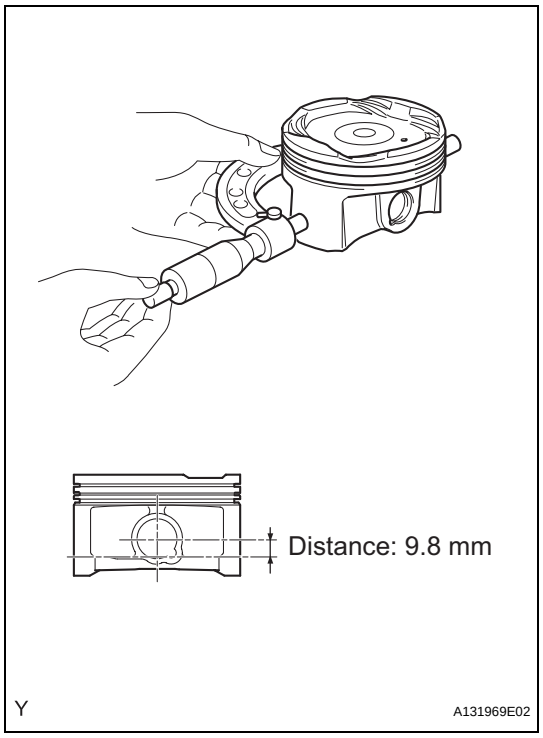


27. INSPECT CYLINDER BORE

(a) Using a cylinder gauge, measure the cylinder bore diameter at positions A and B in the thrust and axial directions.

Standard diameter:
94.000 to 94.012 mm (3.7008 to 3.7013 in.)
Maximum diameter:
94.200 mm (3.7087 in.)

If the diameter is greater than the maximum, replace the cylinder block.



28. INSPECT PISTON SUB-ASSEMBLY WITH PIN

(a) Using a micrometer, measure the piston diameter at right angles to the piston center line where the distance from the bottom edge of the piston is as specified.

Distance:
9.8 mm (0.3858 in.)
Standard diameter:
93.960 to 93.980 mm (3.6992 to 3.6999 in.)
Maximum diameter:
93.830 mm (3.6941 in.)

29. INSPECT PISTON OIL CLEARANCE

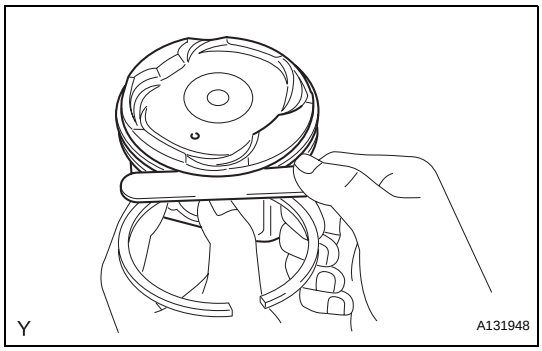
(a) Measure the cylinder bore diameter in the thrust direction.

(b) Subtract the piston diameter measurement from the cylinder bore diameter measurement.

Standard oil clearance:
0.020 to 0.052 mm (0.0007 to 0.0020 in.)
Maximum oil clearance:
0.06 mm (0.0024 in.)

If the oil clearance is greater than the maximum, replace all the pistons. If necessary, replace the cylinder block.

EM



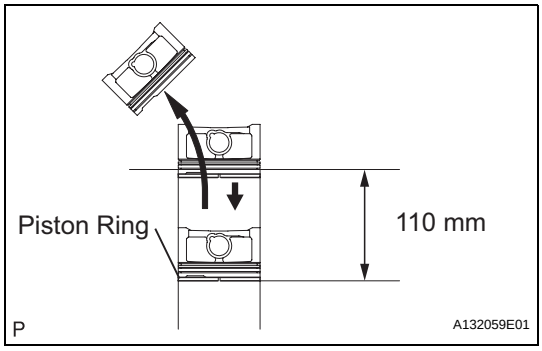
30. INSPECT RING GROOVE CLEARANCE

(a) Using a feeler gauge, measure the clearance between a new piston ring and the wall of the ring groove.

Standard ring groove clearance

Item	Specified Condition
No. 1	0.020 to 0.070 mm (0.0008 to 0.0028 in.)
No. 2	0.020 to 0.060 mm (0.0008 to 0.0024 in.)
Oil	0.070 to 0.150 mm (0.0028 to 0.0059 in.)

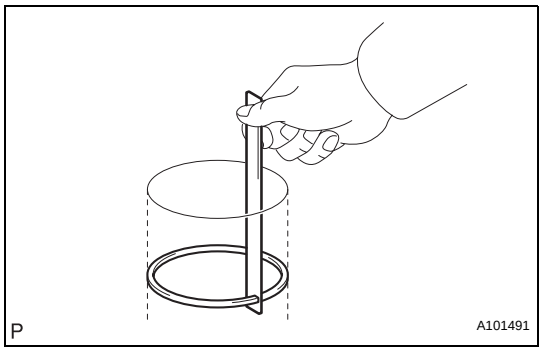
If the clearance is not as specified, replace the piston.



31. INSPECT PISTON RING END GAP

(a) Insert the piston ring into the cylinder bore.

(b) Using a piston, push the piston ring a little beyond the bottom of the ring travel, 110 mm (4.33 in.) from the top of the cylinder block.



(c) Using a feeler gauge, measure the end gap.

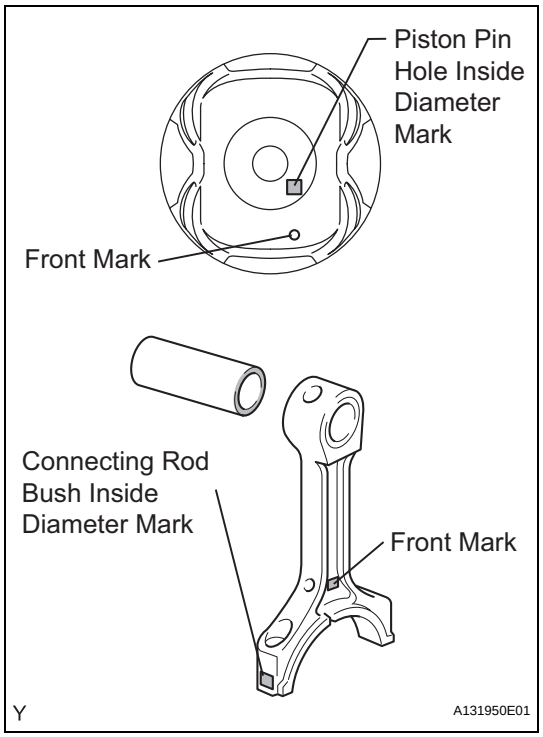
Standard end gap

Item	Specified Condition
No. 1	0.25 to 0.35 mm (0.0098 to 0.0138 in.)
No. 2	0.50 to 0.60 mm (0.0197 to 0.0236 in.)
Oil	0.10 to 0.40 mm (0.0039 to 0.0157 in.)

Maximum end gap

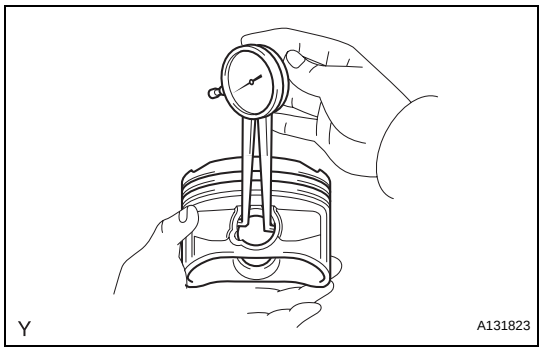
Item	Specified Condition
No. 1	0.50 mm (0.0197 in.)
No. 2	0.85 mm (0.0335 in.)
Oil	0.60 mm (0.0236 in.)

If the end gap is greater than the maximum, replace the piston ring. If the end gap is greater than the maximum even with a new piston ring, replace the cylinder block.



32. INSPECT PISTON PIN OIL CLEARANCE

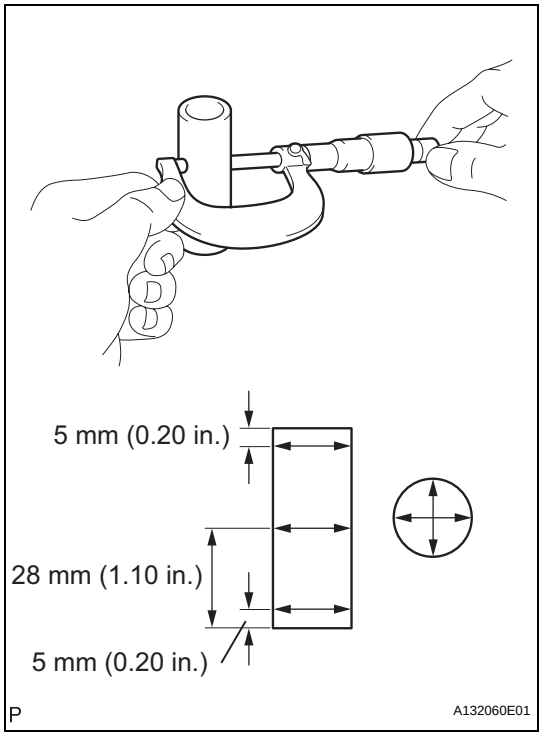
(a) Check each mark on the piston, piston pin and connecting rod.



(b) Using a caliper gauge, measure the inside diameter of the piston pin hole.

Standard piston pin hole inside diameter

Mark	Specified Condition
A	22.001 to 22.004 mm (0.8662 to 0.8663 in.)
B	22.005 to 22.007 mm (0.8663 to 0.8664 in.)
C	22.008 to 22.010 mm (0.8665 to 0.8665 in.)



(c) Using a micrometer, measure the piston pin diameter.

Standard piston pin diameter

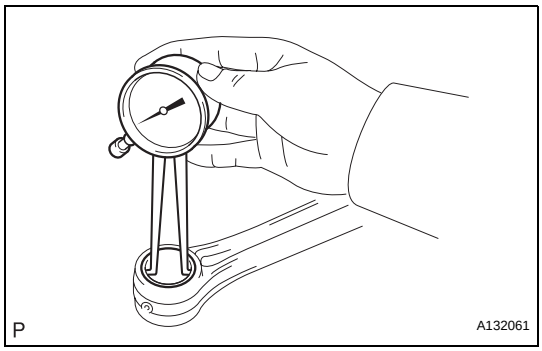
Mark	Specified Condition
A	21.997 to 22.000 mm (0.8660 to 0.8661 in.)
B	22.001 to 22.003 mm (0.8662 to 0.8663 in.)
C	22.004 to 22.006 mm (0.8663 to 0.8664 in.)

(d) Subtract the piston pin diameter measurement from the piston pin hole diameter measurement.

Standard oil clearance:
0.001 to 0.007 mm (0.00004 to 0.0003 in.)
Maximum oil clearance:
0.015 mm (0.0006 in.)

HINT:
If the oil clearance is greater than the maximum, replace the piston and piston pin as a set.

EM



(e) Using a caliper gauge, measure the inside diameter of the connecting rod bush.

Standard bush inside diameter

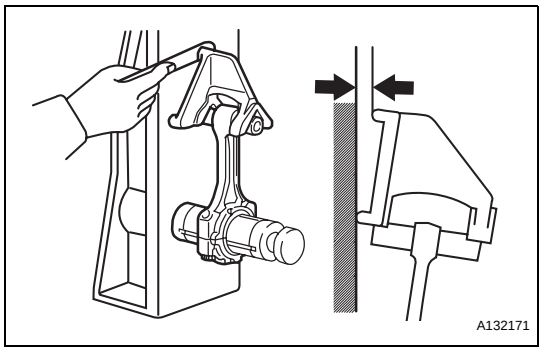
Mark	Specified Condition
A	22.005 to 22.008 mm (0.8663 to 0.8665 in.)
B	22.009 to 22.011 mm (0.8665 to 0.8666 in.)
C	22.012 to 22.014 mm (0.8666 to 0.8667 in.)

(f) Subtract the piston pin diameter measurement from the bush inside diameter measurement.

Standard oil clearance:
0.005 to 0.011 mm (0.0002 to 0.0004 in.)
Maximum oil clearance:
0.03 mm (0.0012 in.)

HINT:
If the oil clearance is greater than the maximum, replace the bush. If necessary, replace the connecting rod and piston pin as a set.

EM

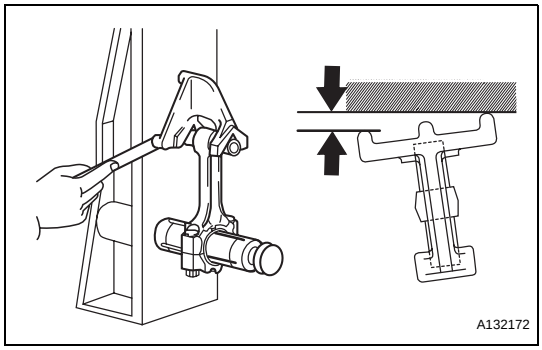


33. INSPECT CONNECTING ROD SUB-ASSEMBLY

(a) Using a rod aligner and feeler gauge, check the connecting rod alignment.

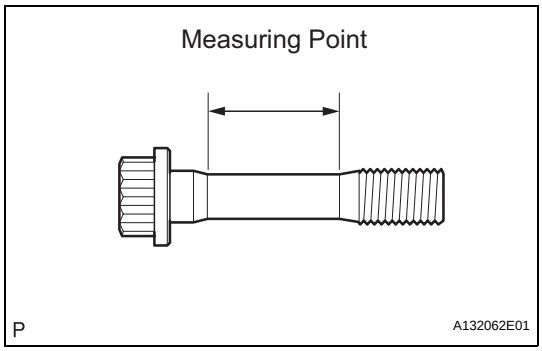
(1) Check for bend.

Maximum bend:
0.05 mm (0.0020 in.) per 100 mm (3.94 in.)
If the bend is greater than the maximum, replace the connecting rod.



(2) Check for twist.

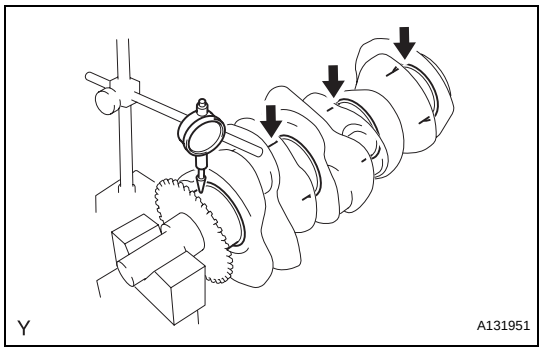
Maximum twist:
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)
If the twist is greater than the maximum, replace the connecting rod.



34. INSPECT CONNECTING ROD BOLT

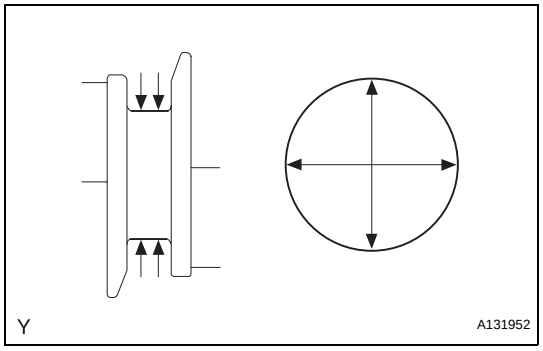
(a) Using a vernier caliper, measure the tension portion diameter of the bolt.

Standard diameter:
7.2 to 7.3 mm (0.283 to 0.287 in.)
Minimum diameter:
7.0 mm (0.276 in.)
If the diameter is less than the minimum, replace the bolt.

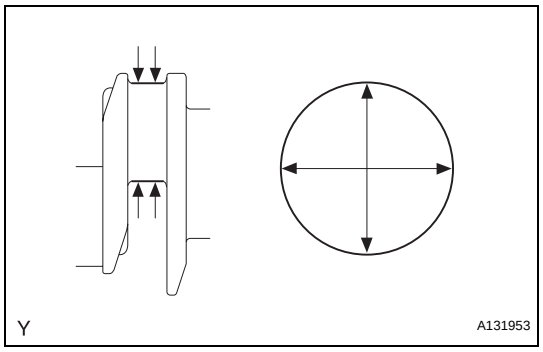


35. INSPECT CRANKSHAFT

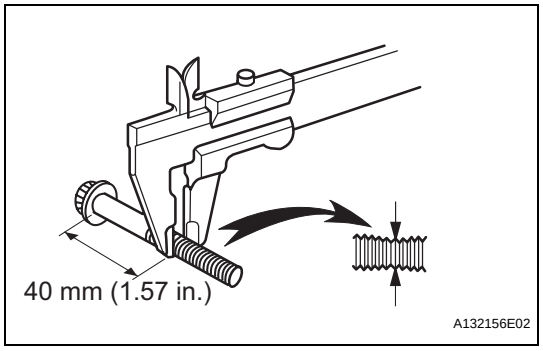
(a) Inspect for circle runout.
  (1) Place the crankshaft on the V-blocks.
  (2) Using a dial indicator, measure the circle runout at the center journal.
  Maximum circle runout:
  0.06 mm (0.0024 in.)
  If the circle runout is greater than the maximum, replace the crankshaft.



(b) Inspect the main journals.
  (1) Using a micrometer, measure the diameter of each main journal.
  Standard journal diameter:
  60.988 to 61.00 mm (2.4011 to 2.4016 in.)
  If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.
  (2) Check each main journal for taper and out-of-round as shown in the illustration.
  Maximum taper and out-of-round:
  0.02 mm (0.0008 in.)
  If the taper and out-of-round is greater than the maximum, replace the crankshaft.



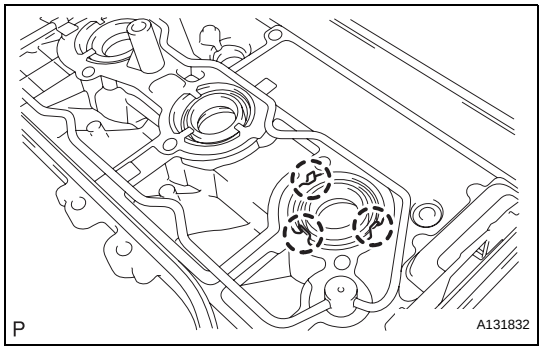
(c) Inspect the crank pin.
  (1) Using a micrometer, measure the diameter of each crank pin.
  Standard crank pin diameter:
  52.992 to 53.000 mm (2.0863 to 2.0866 in.)
  If the diameter is not as specified, check the oil clearance. If necessary, replace the crankshaft.
  (2) Check each crank pin for taper and out-of-round as shown in the illustration.
  Maximum taper and out-of-round:
  0.02 mm (0.0008 in.)
  If the taper and out-of-round is greater than the maximum, replace the crankshaft.



36. INSPECT CRANKSHAFT BEARING CAP SET BOLT

(a) Using a vernier caliper, measure the minimum diameter of the compressed thread at the measuring point.
  Standard diameter:
  10.8 to 11.0 mm (0.4252 to 0.4331 in.)
  Minimum diameter:
  10.70 mm (0.4213 in.)
  If the diameter is less than the minimum, replace the bolt.

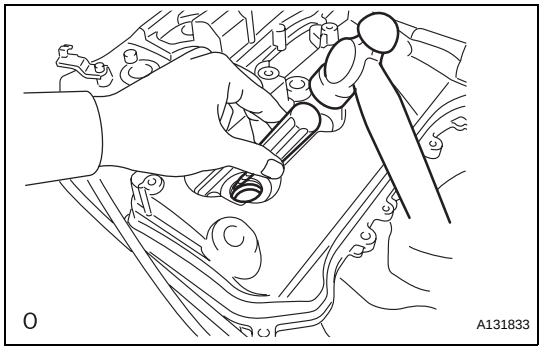
EM



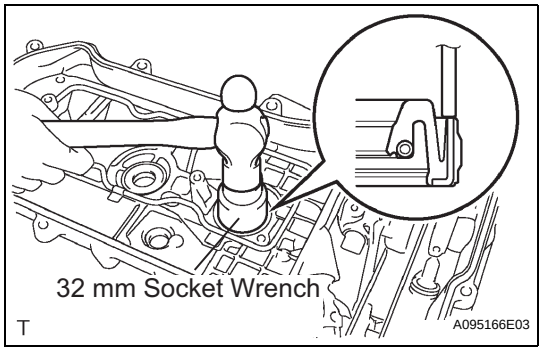
REPLACEMENT

1. REPLACE SPARK PLUG TUBE GASKET

(a) Pry up the claws of the ventilation baffle plate.



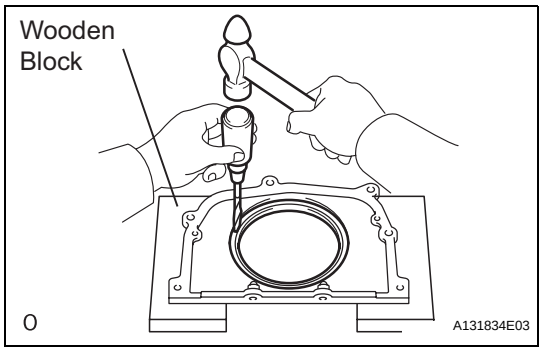
(b) Using a screwdriver with its tip taped and a hammer, tap out the 6 spark plug tube gaskets.



(c) Using a 32 mm socket wrench, tap in 6 new spark plug tube gaskets to the head covers.
NOTICE:
- **Keep the lip free from foreign matter.**
- **Do not tap on the oil seal at an angle.**

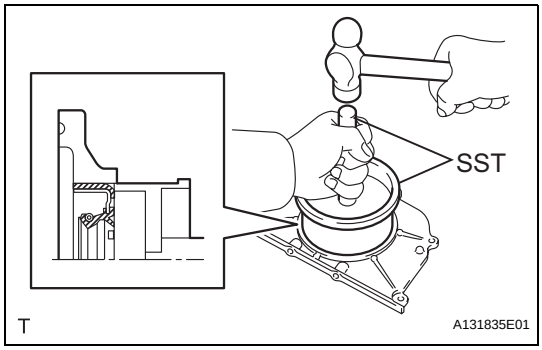
(d) Return the claw of the ventilation baffle plate to its original position.

2. REPLACE ENGINE REAR OIL SEAL

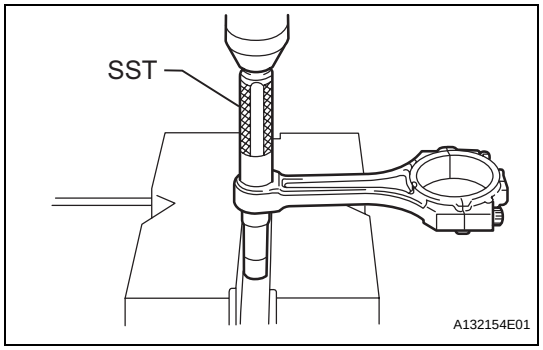


(a) Place the oil seal retainer on wooden blocks.

(b) Using a screwdriver and a hammer, tap out the oil seal.

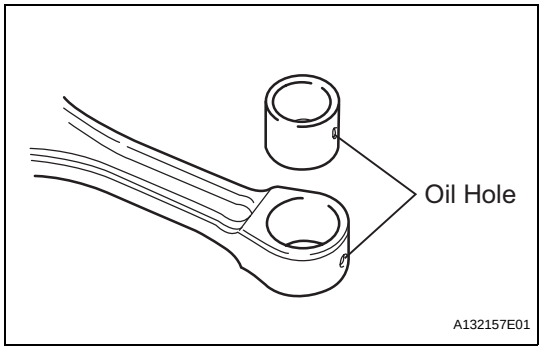


(c) Using SST, tap in a new oil seal until its surface is flush with the oil seal retainer edge.
SST 09223-15030
NOTICE:
- **Keep the lip free from foreign matter.**
- **Do not tap on the oil seal at an angle.**

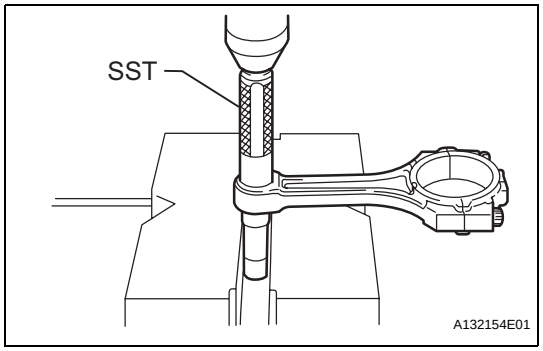


3. REPLACE CONNECTING ROD SMALL END BUSH

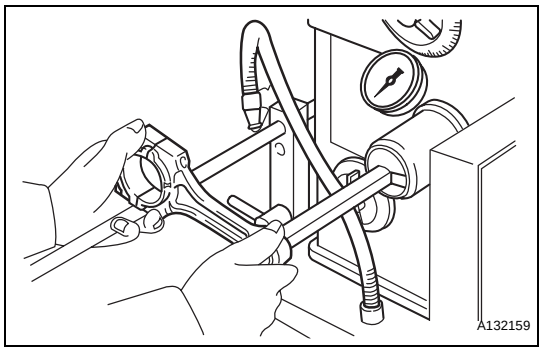
(a) Using SST and a press, push out the bush.
SST 09222-30010



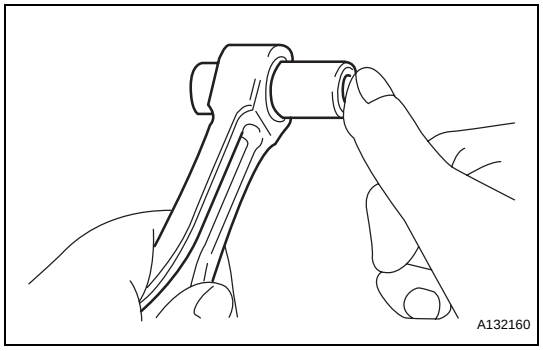
(b) Align the oil holes of the new bush and connecting rod.



(c) Using SST and a press, push in the bush.
SST 09222-30010



(d) Using a pin hole grinder, hone the bush to obtain the standard specified clearance between the bush and piston pin.

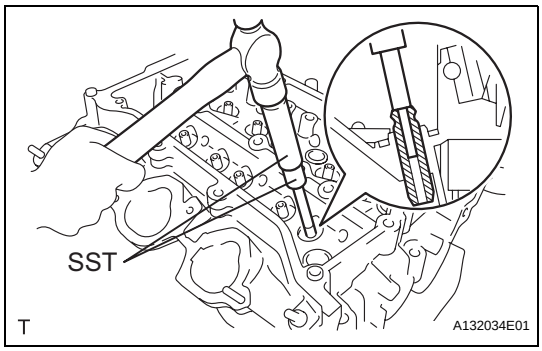


(e) Coat the piston pin with engine oil. Push the piston pin into the connecting rod with your thumb to check that the piston pin fits at normal room temperature.

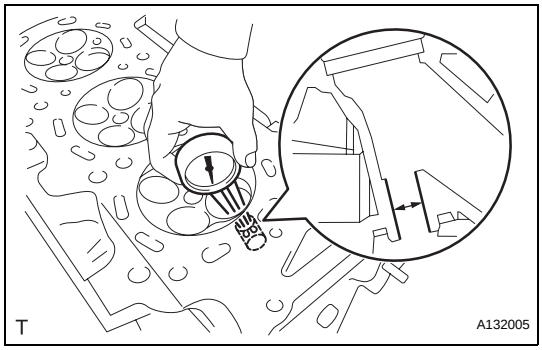
4. REPLACE INTAKE VALVE GUIDE BUSH

(a) Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).
(b) Place the cylinder head on wooden blocks.

EM



(c) Using SST and a hammer, tap out the valve guide bush.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



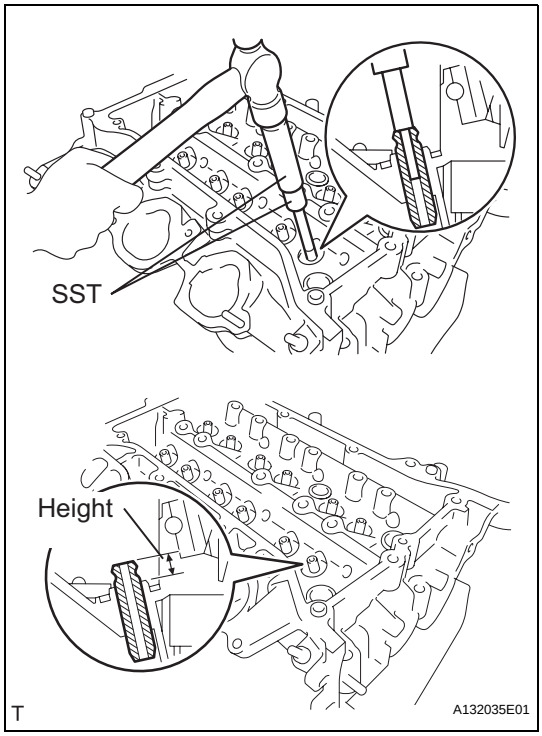
(d) Using a caliper gauge, measure the bush bore diameter of the cylinder head.
Standard cylinder bore diameter:
10.285 to 10.306 mm (0.4049 to0.4057 in.)

(e) Select a new guide bush (STD or O/S 0.05).
Standard bush bore diameter

Bush Size	Specified Condition
Use STD	10.335 to 10.356 mm (0.4069 to 0.4077 in.)
Use O/S 0.05	10.285 to 10.306 mm (0.4049 to 0.4057 in.)

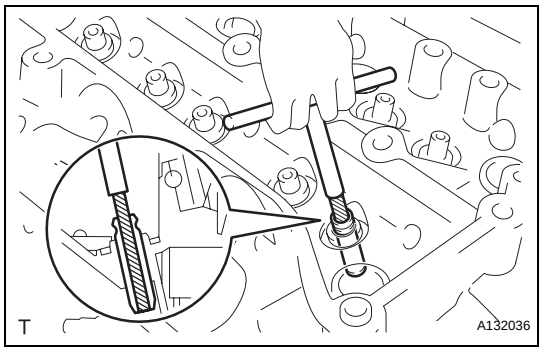
HINT:
- If the bush bore diameter of the cylinder head is greater than 10.344 mm (0.4072 in.), machine the bush bore diameter to between 10.383 to 10.394 mm (0.4088 to 0.4092 in.).
- If the bush bore diameter of the cylinder head is greater than 10.344 mm (0.4072 in.), replace the cylinder head.

(f) Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).



(g) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.
Standard protrusion height:
9.1 to 9.9 mm (0.3582 to 0.3900 in.)
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)

EM

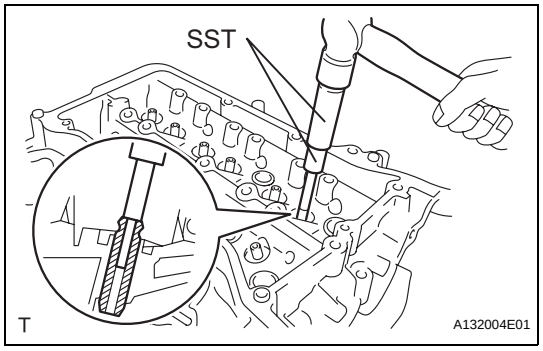


(h) Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and valve stem.

5. REPLACE EXHAUST VALVE GUIDE BUSH

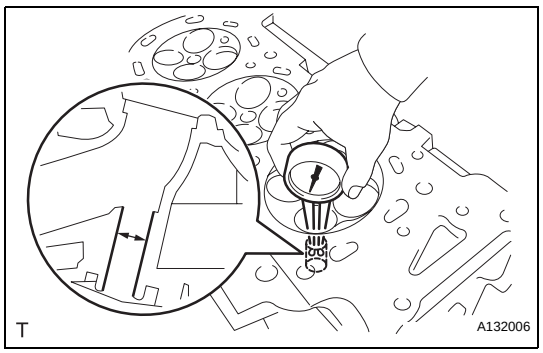
(a) Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).

(b) Place the cylinder head on wooden blocks.



(c) Using SST and a hammer, tap out the valve guide bush.

SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)



(d) Using a caliper gauge, measure the bush bore diameter of the cylinder head.

Standard cylinder bore diameter:
10.285 to 10.306 mm (0.4049 to 0.4057 in.)

(e) Select a new guide bush (STD or O/S 0.05).

Standard bush bore diameter

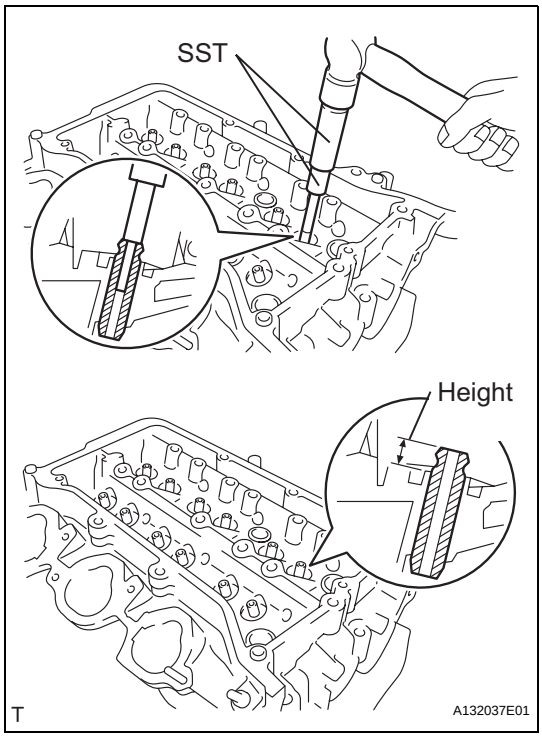
Bush Size	Specified Condition
Use STD	10.335 to 10.356 mm (0.4069 to 0.4077 in.)
Use O/S 0.05	10.285 to 10.306 mm (0.4049 to 0.4057 in.)

HINT:

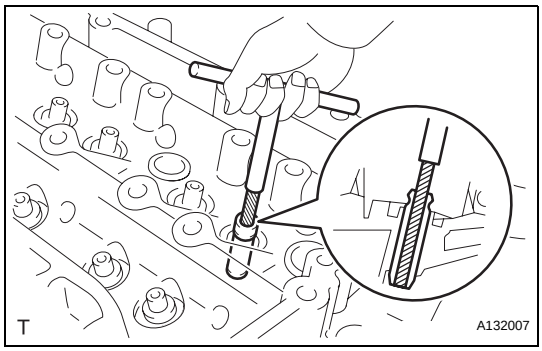
- If the bush bore diameter of the cylinder head is greater than 10.344 mm (0.4072 in.), machine the bush bore diameter to between 10.383 to 10.394 mm (0.4088 to 0.4092 in.).
- If the bush bore diameter of the cylinder head is greater than 10.344 mm (0.4072 in.), replace the cylinder head.

(f) Heat the cylinder head to approximately 80 to 100°C (176 to 212°F).

EM

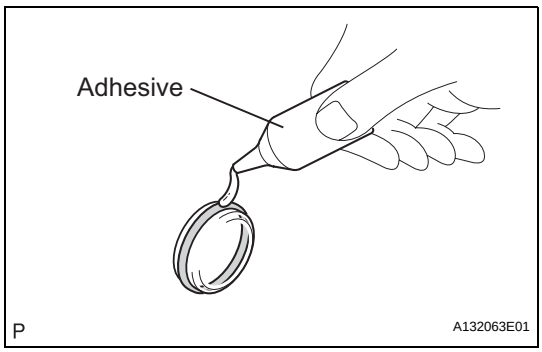


(g) Using SST and a hammer, tap in a new guide bush to the specified protrusion height.
SST 09201-10000 (09201-01050), 09950-70010 (09951-07100)
Standard protrusion height:
9.30 to 9.70 mm (0.3661 to 0.3819 in.)



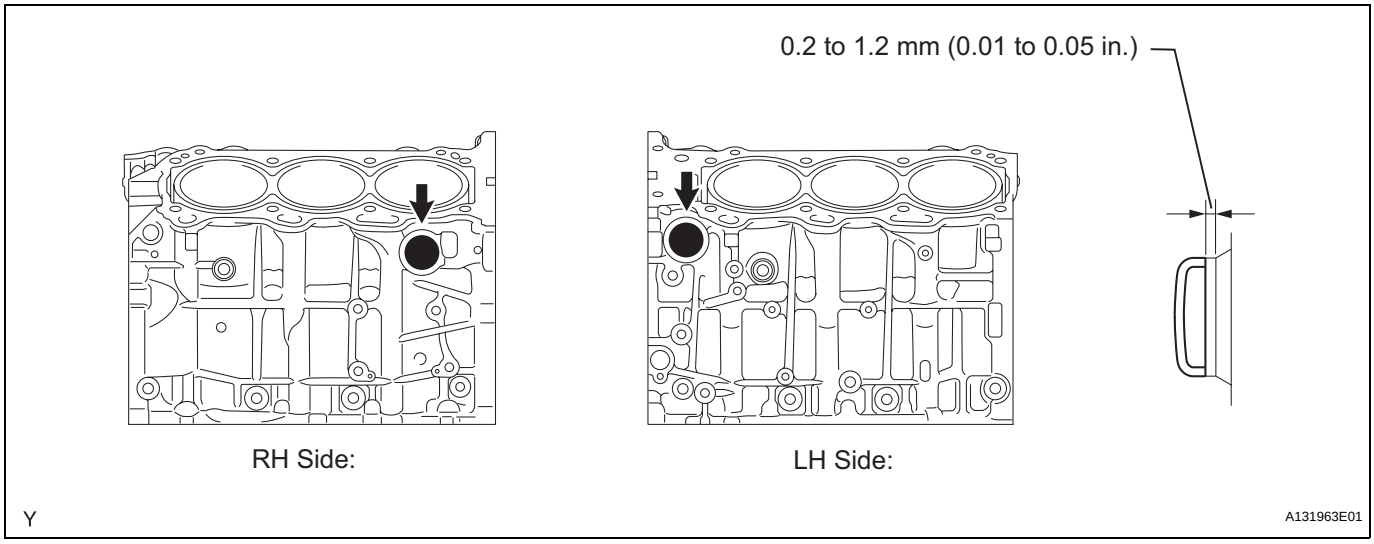
(h) Using a sharp 5.5 mm reamer, ream the guide bush to obtain the standard specified clearance between the guide bush and valve stem.

6. REPLACE CYLINDER BLOCK TIGHT PLUG
NOTICE:
If water leaks from the tight plug or the plug corrodes, replace it.
(a) Remove the tight plugs.



(b) Apply adhesive around the tight plug.
Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent
(c) Using SST and a hammer, tap in 2 new tight plugs as shown in the illustration.
SST 09950-60010 (09951-00340), 09950-70010 (09951-07100)

EM



7. REPLACE CYLINDER BLOCK STUD BOLT

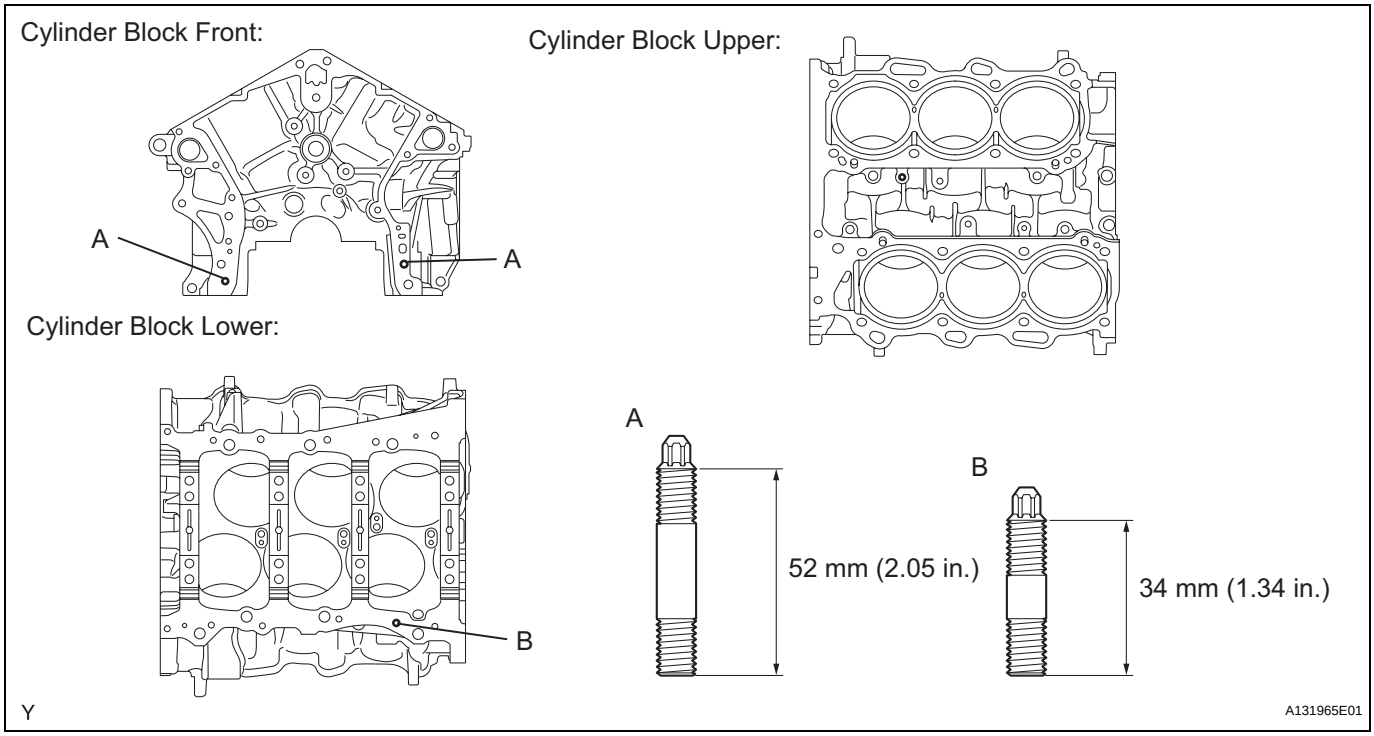
NOTICE:

If a stud bolt is deformed or the threads are damaged, replace it.

(a) Remove the stud bolts.

(b) Using an E8 "torx" socket wrench, install the stud bolts.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



8. REPLACE CYLINDER BLOCK STRAIGHT PIN

NOTICE:

It is not necessary to remove the straight pin unless it is being replaced.

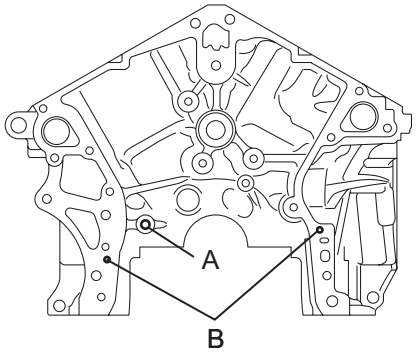
(a) Remove the straight pin.

(b) Using a plastic-faced hammer, tap in new straight pins to the cylinder block.

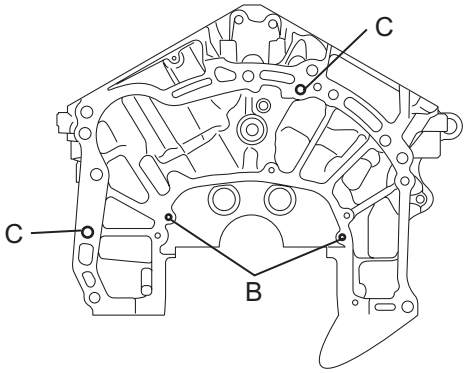
Standard protrusion

Item	Specified Condition
Pin A	23 mm (0.91 in.)
Pin B	6 mm (0.24 in.)
Pin C	11 mm (0.43 in.)
Pin D	9 mm (0.35 in.)

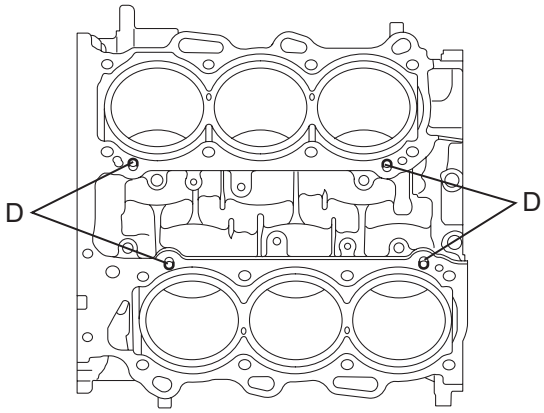
Cylinder Block Front:



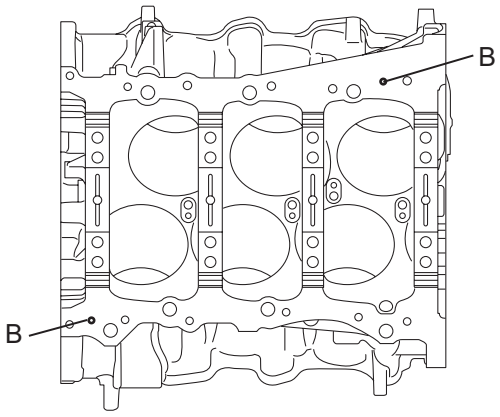
Cylinder Block Rear:



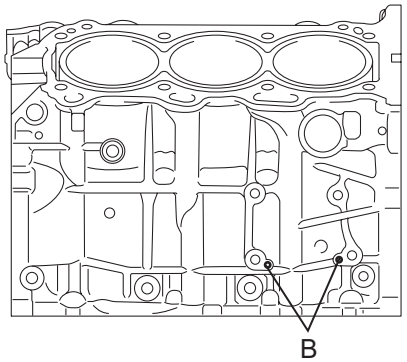
Cylinder Block Upper:

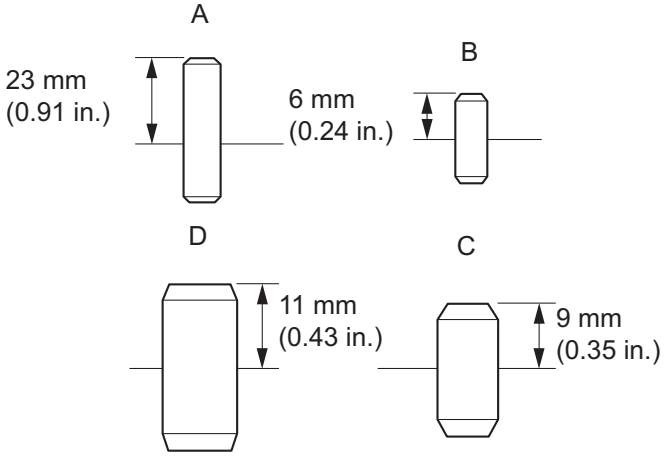


Cylinder Block Lower:



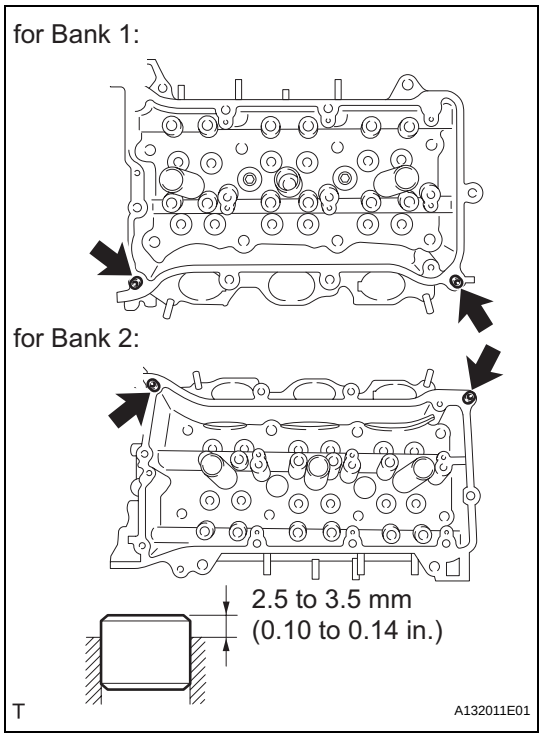
Cylinder Block RH Side:





Y

A131964E01



9. REPLACE CYLINDER HEAD RING PIN

NOTICE:

It is not necessary to remove the ring pin unless it is being replaced.

(a) Remove the ring pins.

(b) Using a plastic-faced hammer, tap in a new ring pin until the pin stops.

10. REPLACE CYLINDER HEAD STUD BOLT

NOTICE:

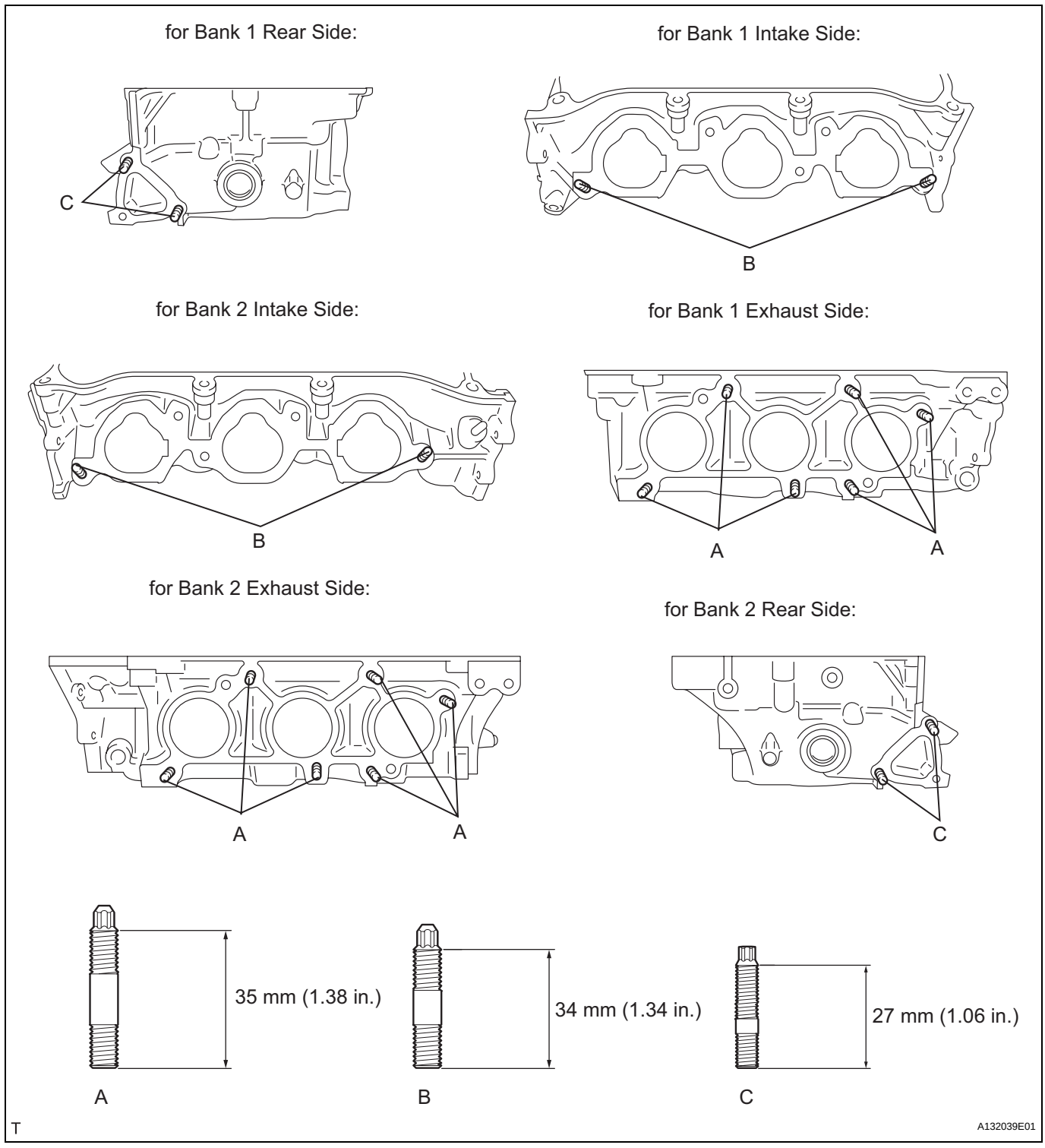
If a stud bolt is deformed or the threads are damaged, replace it.

(a) Remove the stud bolts.

(b) Using E6 and E8 "torx" socket wrenches, install the stud bolts.

Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf) for stud bolts A and B
4.0 N*m (41 kgf*cm, 35 in.*lbf) for stud bolt C

EM



11. REPLACE CYLINDER HEAD SET STRAIGHT PIN

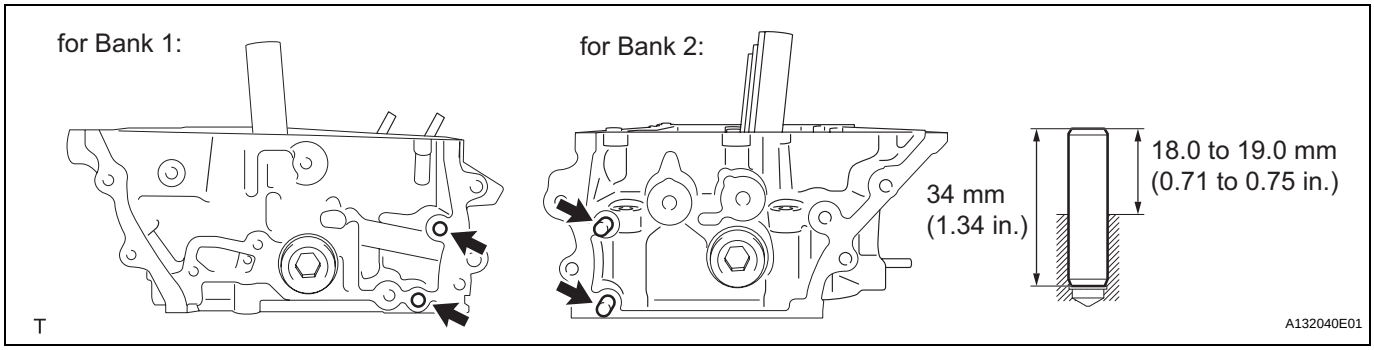
NOTICE:

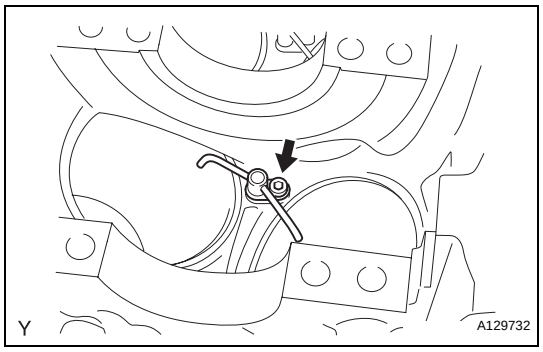
It is not necessary to remove the straight pin unless it is being replaced.

(a) Using a plastic-faced hammer, tap in a new straight pin as shown in the illustration.

Standard protrusion height:

18.0 to 19.0 mm (0.71 to 0.75 in.)



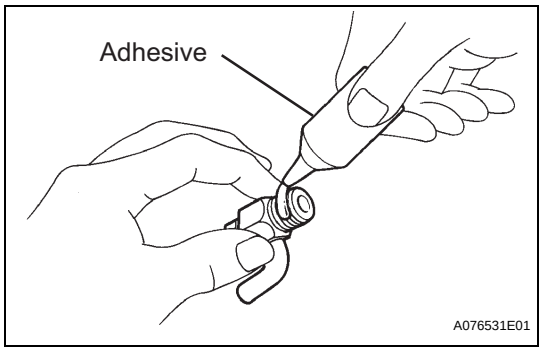


REASSEMBLY

1. INSTALL NO. 1 OIL NOZZLE SUB-ASSEMBLY

(a) Using a 5 mm hexagon wrench, install the 3 oil nozzles with the bolts.
Torque: 9.0 N*m (92 kgf*cm, 80 in.*lbf)

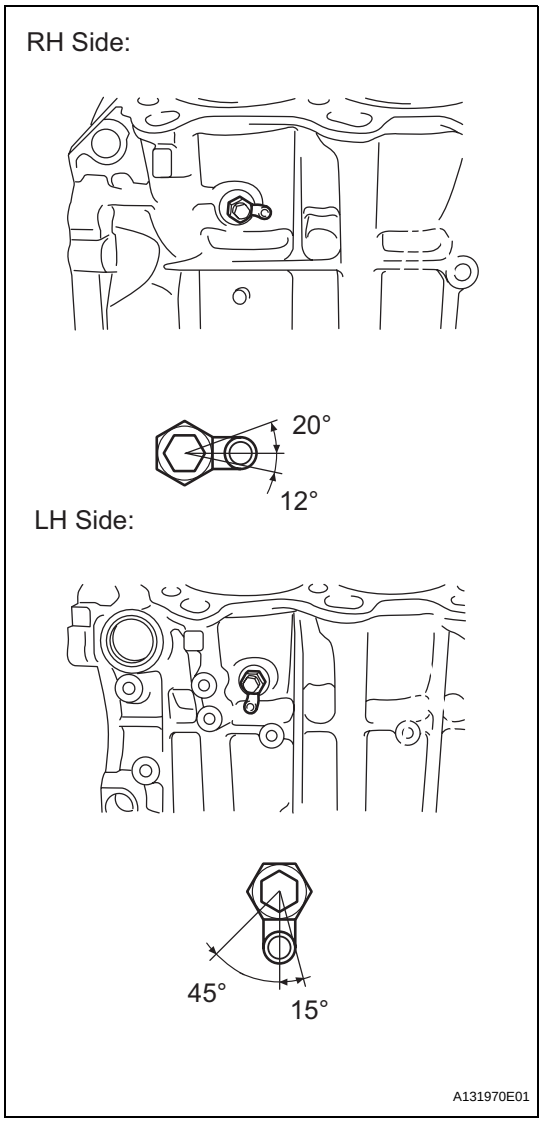
EM



2. INSTALL CYLINDER BLOCK WATER DRAIN COCK SUB-ASSEMBLY

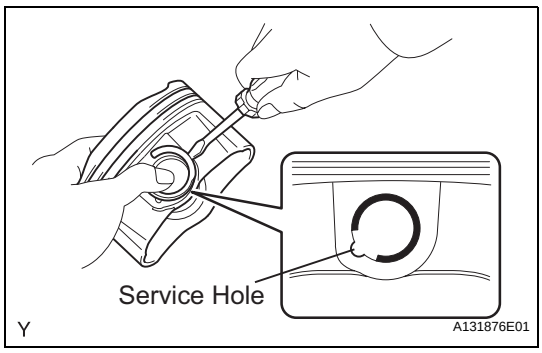
(a) Apply adhesive around the drain cocks.
Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent

(b) Install the cylinder block water drain cocks.
(1) Temporarily install the drain cocks.
Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)



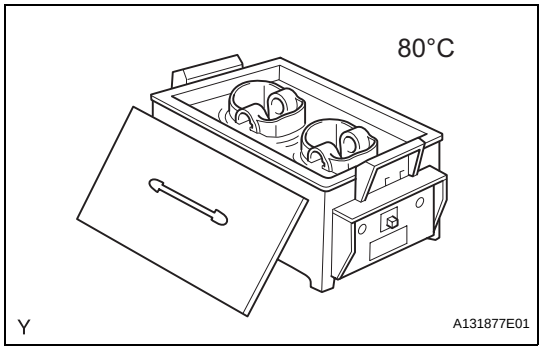
(2) Within one full rotation, tighten the drain cock to the angle shown in the illustration.
Torque: 45 N*m (459 kgf*cm, 33 ft.*lbf)
NOTICE:
Do not loosen the drain cock to adjust it. If an adjustment is necessary, remove the drain cock and reinstall it.

(c) Install the water drain cock plug to the water drain cocks.
Torque: 13 N*m (130 kgf*cm, 9 ft.*lbf)



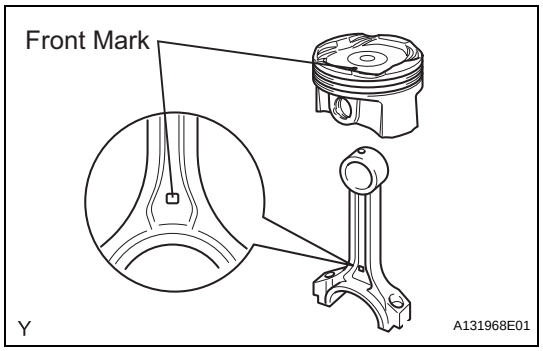
3. INSTALL PISTON WITH PIN SUB-ASSEMBLY

(a) Using a screwdriver, install a new snap ring at one end of the piston pin hole.
HINT:
Be sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

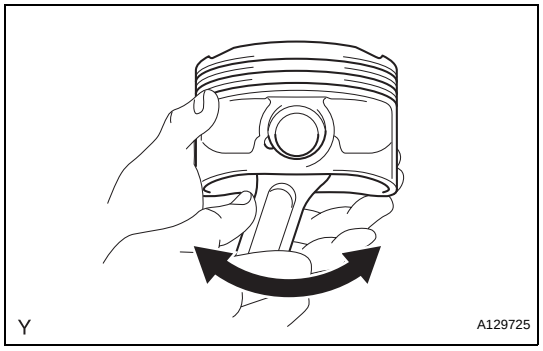


(b) Gradually heat the piston to approximately 80°C (176°F).

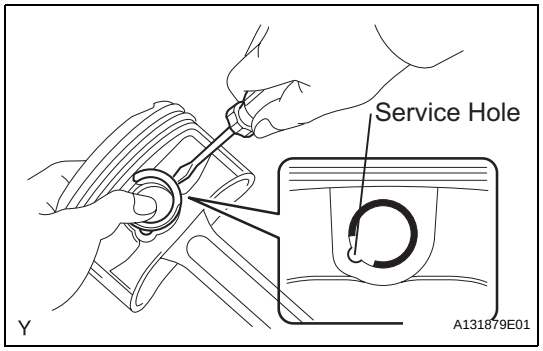
(c) Coat the piston pin with engine oil.



(d) Align the front marks of the piston and connecting rod, and push in the piston pin with your thumb.
HINT:
The piston and pin are a matched set.



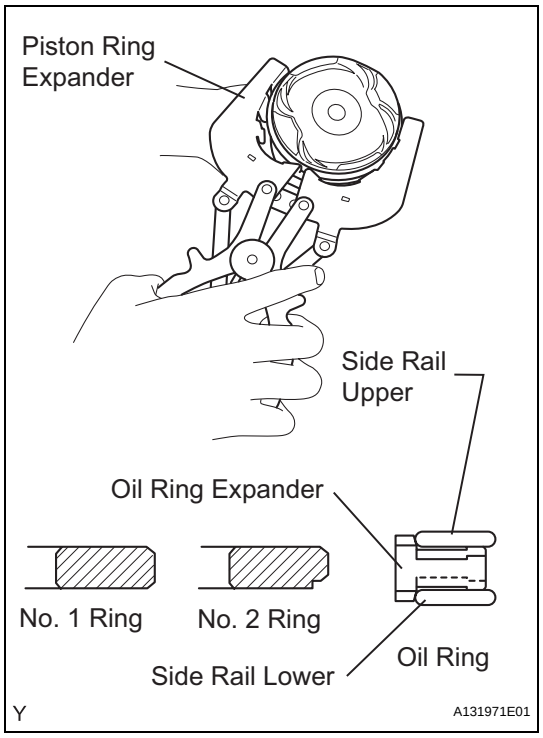
(e) Check the fitting condition between the piston and piston pin by trying to move the piston back and forth on the piston pin.



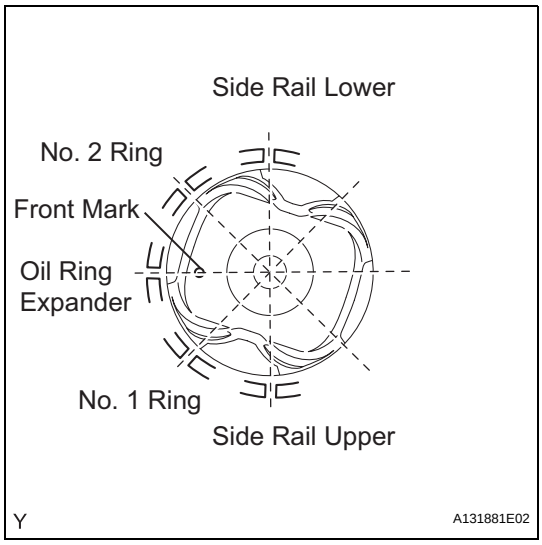
(f) Using a screwdriver, install a new snap ring at the other end of the piston pin hole.
HINT:
Be sure that the end gap of the snap ring is not aligned with the pin hole cutout portion of the piston.

4. INSTALL PISTON RING SET

(a) Install the oil ring expander and 2 side rails by hand.

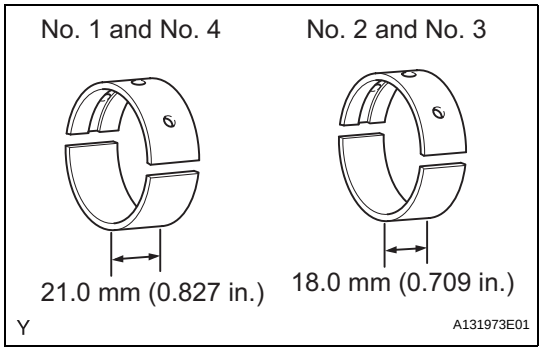


(b) Using a piston ring expander, install the 2 compression rings so that the painted marks are positioned as shown in the illustration.

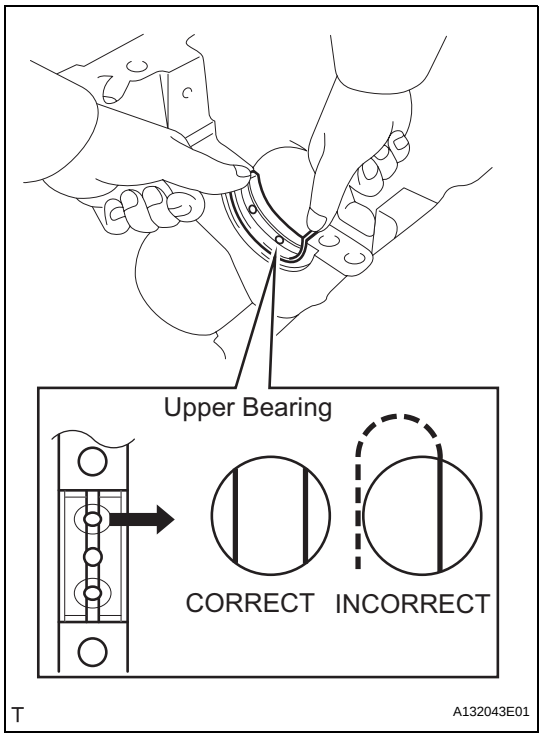


(c) Position the piston rings so that the ring ends are as shown in the illustration.
NOTICE:
Do not align the ring ends.

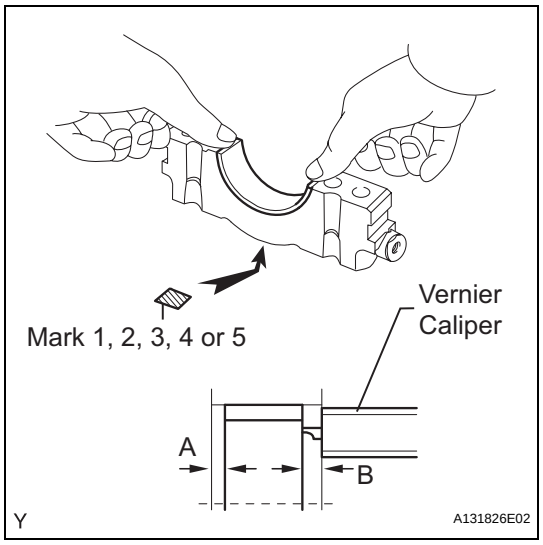
5. INSTALL CRANKSHAFT BEARING
NOTICE:
Main bearings come in widths between 18.0 mm (0.709 in.) and 21.0 mm (0.827 in.). Install the 21.0 mm (0.827 in.) bearings in the No. 1 and No. 4 cylinder block journal positions with the main bearing cap. Install the 18.0 mm (0.709 in.) bearings in the No. 2 and No. 3 positions.



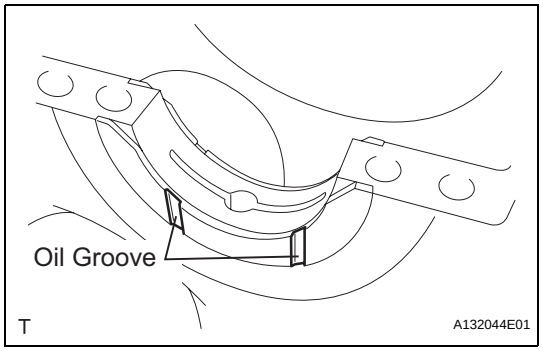
(a) Clean the main journal and both surfaces of the bearing.



(b) Install the upper bearing.
(1) Install the upper bearing to the cylinder block as shown in the illustration.
NOTICE:
Do not apply engine oil to the bearing and its contact surface.



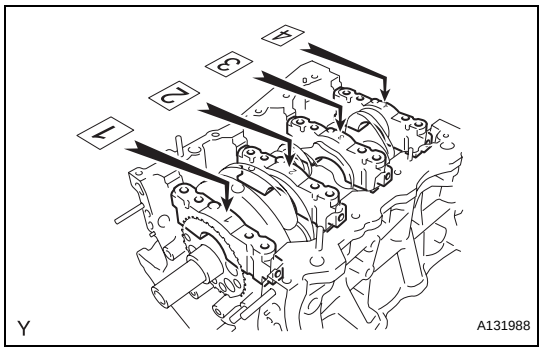
(c) Install the lower bearing.
(1) Install the lower bearing to the bearing cap.
(2) Using a vernier caliper, measure the distance between the bearing cap's edge and the lower bearing's edge.
Dimension (A - B):
0.7 mm (0.028 in.) or less.
NOTICE:
Do not apply engine oil to the bearing's contact area and underside.



6. INSTALL CRANKSHAFT

(a) Install the 2 thrust washers under the No. 2 journal position of the cylinder block with the oil grooves facing outward.

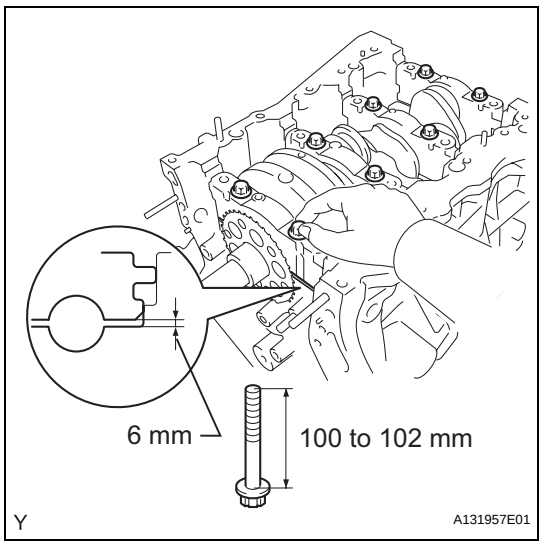
(b) Apply engine oil to the upper bearing, then place the crankshaft on the cylinder block.



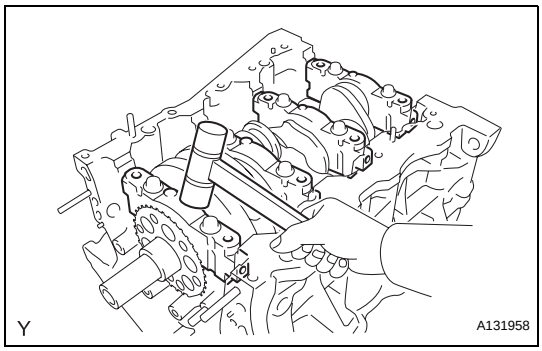
(c) Confirm the front marks and numbers of the main bearing caps and install the bearing caps on the cylinder block.
HINT:
A number is marked on each main bearing cap to indicate the installation position.

(d) Apply a light coat of engine oil on the threads and under the heads of the bearing cap bolts.

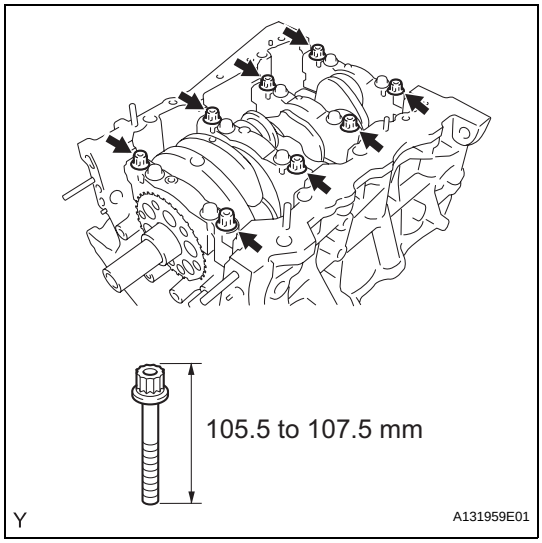
(e) Temporarily install the 8 main bearing cap bolts to the inside positions.



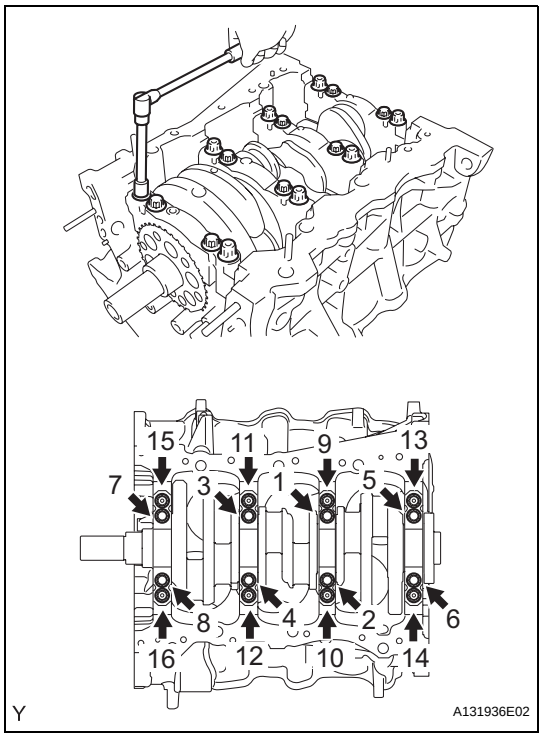
(f) Insert the main bearing cap by hand until the clearance between the main bearing cap and the cylinder block is less than 6 mm (0.23 in.) by marking the 2 internal bearing cap bolts as a guide.
Bolt length:
100.0 to 102.0 mm (3.937 to 4.016 in.)



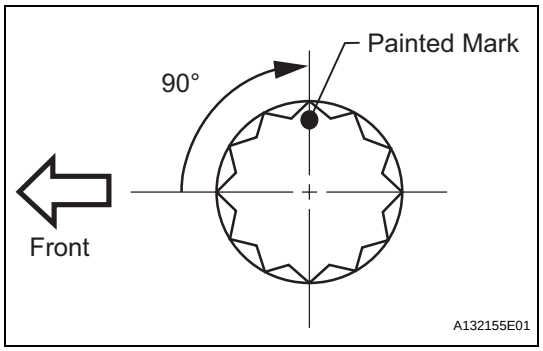
(g) Using a plastic-faced hammer, lightly tap the bearing cap to ensure a proper fit.
(h) Apply a light coat of engine oil to the threads and under the heads of the 8 main bearing cap bolts.



(i) Install the 8 main bearing cap bolts to the outside positions.
Bolt length:
105.5 to 107.5 mm (4.154 to 4.232 in.)
(j) Install the crankshaft bearing cap bolts.
HINT:
The main bearing cap bolts are tightened in 2 progressive steps.

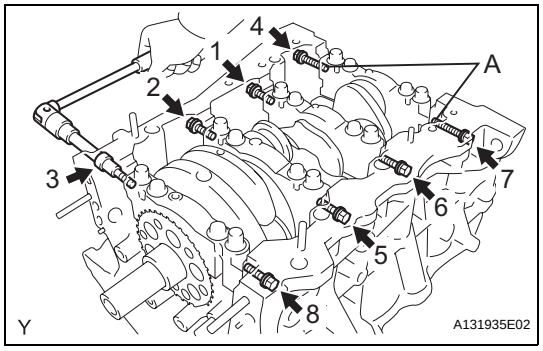


(k) Step 1
(1) Install and uniformly tighten the 16 main bearing cap bolts in the sequence shown in the illustration.
Torque: 61 N*m (622 kgf*cm, 45 ft.*lbf)
If any of the main bearing cap bolts does not meet the specified torque, replace it.



(l) Step 2
  (1) Mark the front of the bearing cap bolts with paint.
  (2) Tighten the bearing cap bolts another 90° in the order shown in step 1.
  (3) Check that the painted mark is now at a 90° angle to the front.

(m) Check that the crankshaft turns smoothly.



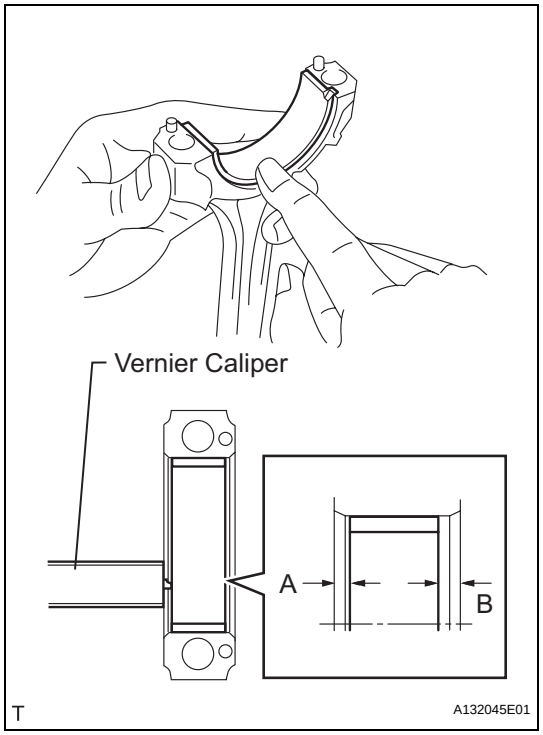
(n) Install and uniformly tighten the 8 main bearing cap bolts in several steps, in the sequence shown in the illustration.
Torque: 52 N*m (530 kgf*cm, 38 ft.*lbf)
Bolt length:
45 mm (1.77 in.) for bolt A
30 mm (1.18 in.) for except bolt A

(o) Check that the crankshaft turns smoothly.

7. INSTALL CONNECTING ROD BEARING

(a) Install the connecting rod bearing to the connecting rod and bearing cap.

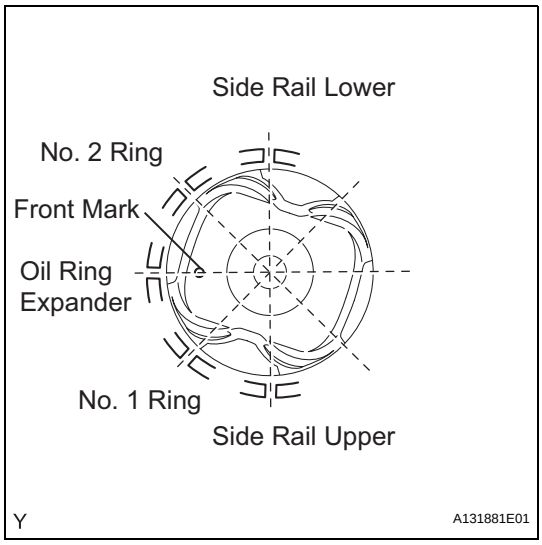
(b) Using a vernier caliper, measure the distance between the connecting rod's and bearing cap's edges, and each connecting rod bearing's edge.
Dimension (A - B):
0.7 mm (0.028 in.) or less
NOTICE:
Do not apply engine oil to the bearing's contact area and underside.



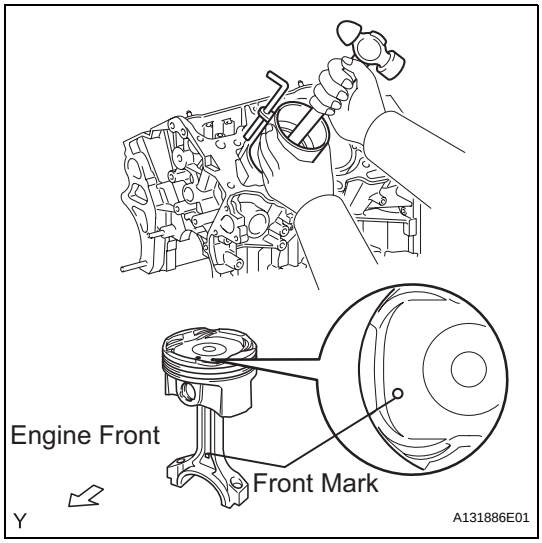
8. INSTALL PISTON SUB-ASSEMBLY WITH CONNECTING ROD

(a) Apply engine oil to the cylinder walls, the pistons, and the surfaces of the connecting rod bearings.

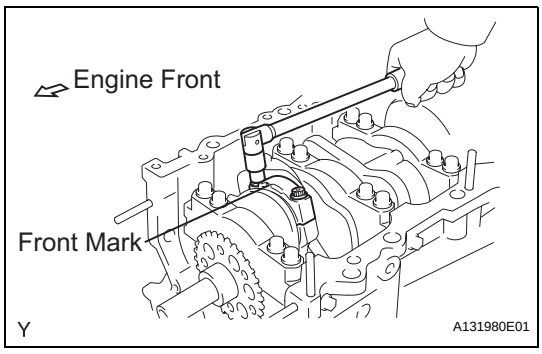
EM



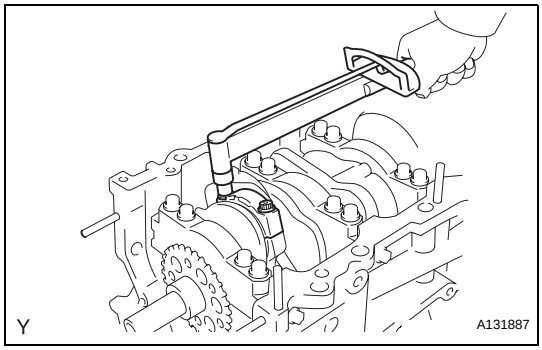
(b) Position the piston rings so that the ring ends are as shown in the illustration.
NOTICE:
Do not align the ring ends.



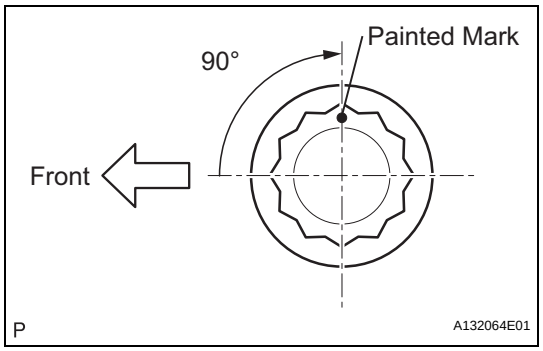
(c) Using a piston ring compressor, push the correctly numbered piston and connecting rod into the cylinder with the front mark of the piston facing forward.
NOTICE:
Match the numbered connecting rod cap with the connecting rod.



(d) Check that the front mark of the connecting rod cap is facing forward.
(e) Apply a light coat of engine oil to the threads and under the heads of the connecting rod cap bolts.
(f) Install the connecting cap bolts.
HINT:
The connecting cap bolts are tightened in 2 progressive steps.

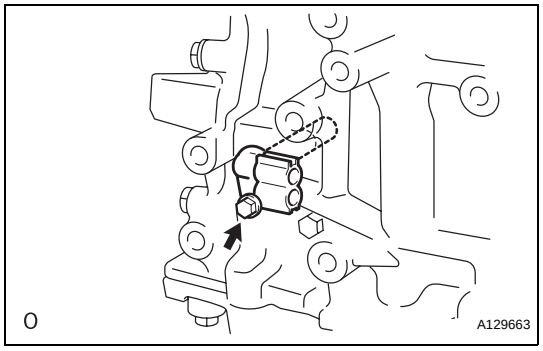


(g) Step 1
(1) Install and alternately tighten the bolts of the connecting rod cap in several steps.
Torque: 25 N*m (255 kgf*cm, 18 ft.*lbf)



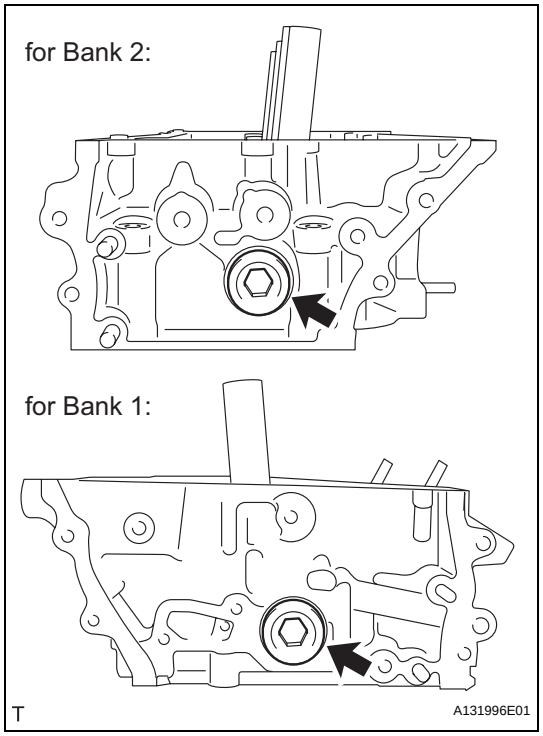
(h) Step 2
  (1) Mark the front side of each connecting cap bolt with paint.
  (2) Tighten the cap bolts another 90° as shown in the illustration in the order in step 1.
  (3) Check that the painted mark is now at a 90° angle to the front.

(i) Check that the crankshaft turns smoothly.



9. INSTALL CRANKSHAFT POSITION SENSOR

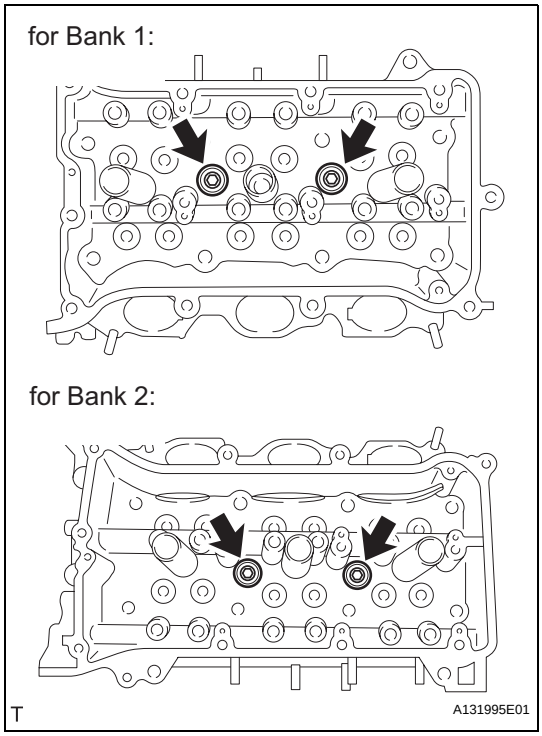
(a) Install the crankshaft position sensor with the bolt.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



10. INSTALL NO. 2 STRAIGHT SCREW PLUG

(a) Using a 14 mm hexagon wrench, install 2 new gaskets and the 2 straight screw plugs.
Torque: 80 N*m (816 kgf*cm, 59 ft.*lbf)

EM

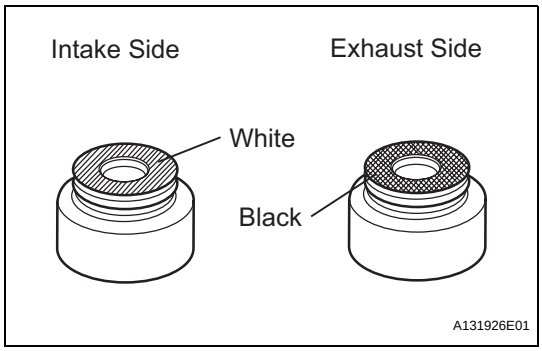


11. INSTALL NO. 1 STRAIGHT SCREW PLUG

(a) Using a 10 mm hexagon wrench, install 4 new gaskets and the straight screw plugs.
Torque: 44 N*m (449 kgf*cm, 32 ft.*lbf)

12. INSTALL VALVE SPRING SEAT

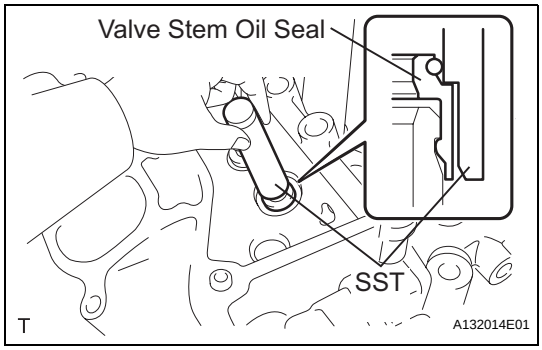
(a) Install the valve spring seats to the cylinder head.

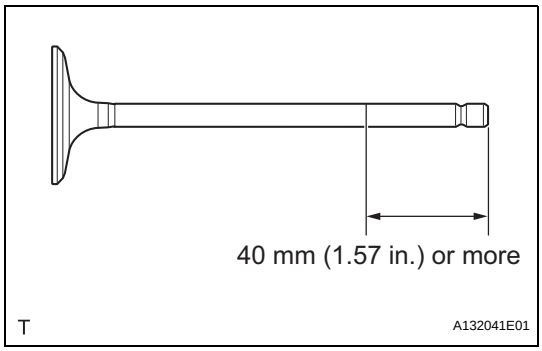


13. INSTALL INTAKE VALVE STEM OIL SEAL

(a) Apply a light coat of engine oil to new oil seals.
NOTICE:
Pay attention when installing the intake and exhaust oil seals. For example, installing the intake oil seal into the exhaust side or installing the exhaust oil seal to the intake side can cause installation problems later.
HINT:
The intake valve oil seals are white and the exhaust valve oil seals are black.

(b) Using SST, push in the oil seals.
SST 09201-41020
NOTICE:
Failure to use SST will cause the seal to be damaged or improperly seated.

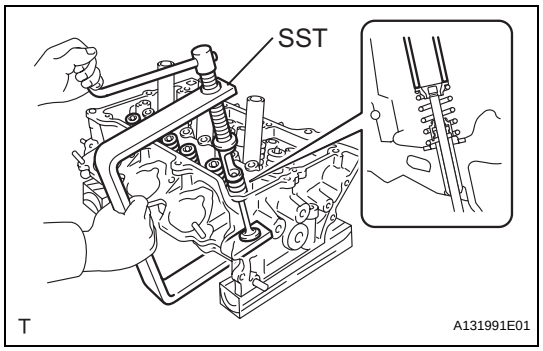




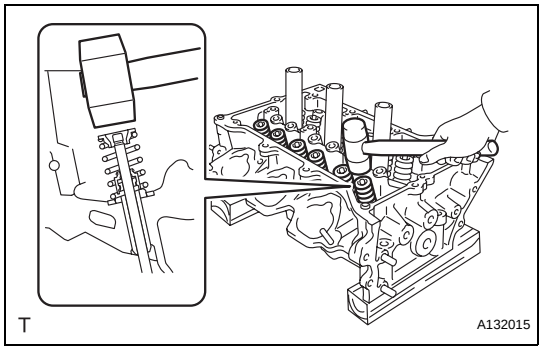
14. INSTALL INTAKE VALVE

(a) Apply plenty of engine oil to the tip area of the intake valve shown in the illustration.

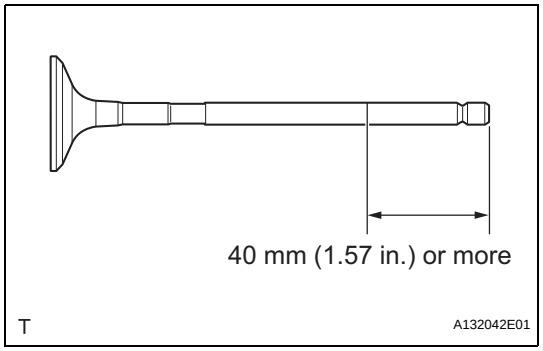
(b) Install the valve, compression spring and spring retainer to the cylinder head.
NOTICE:
Install the same parts in the same combination to original locations.



(c) Using SST and wooden blocks, compress the spring and install the retainer lock.
SST 09202-70020 (09202-00010)

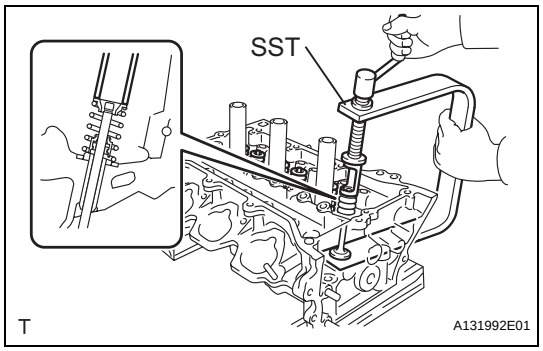


(d) Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.
NOTICE:
Be careful not to damage the retainer.

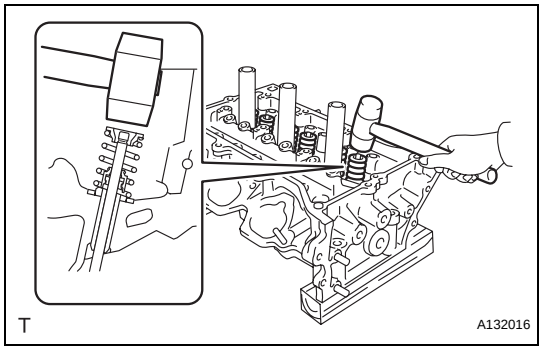


15. INSTALL EXHAUST VALVE

(a) Apply plenty of engine oil to the tip area of the exhaust valve shown in the illustration.
(b) Install the valve, compression spring and spring retainer to the cylinder head.
NOTICE:
Install the same parts in the same combination to their original locations.



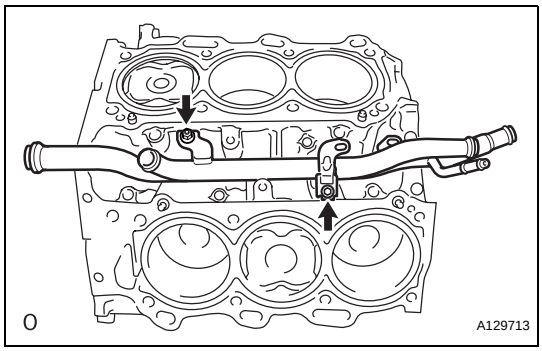
(c) Using SST and wooden blocks, compress the spring and install the retainer lock.
SST 09202-70020 (09202-00010)



(d) Using a plastic-faced hammer, lightly tap the valve stem tip to ensure a proper fit.
NOTICE:
Be careful not to damage the retainer.

16. INSTALL VALVE STEM CAP

(a) Apply a light coat of engine oil to the valve stem caps.
(b) Install the valve stem caps to the cylinder head.



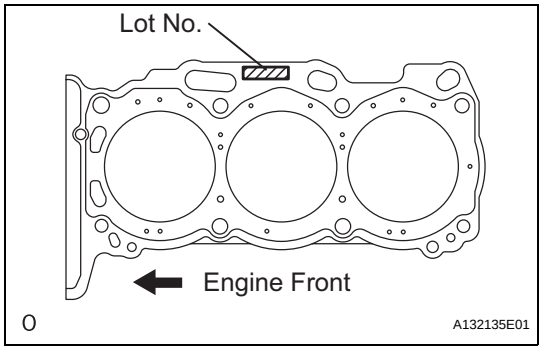
17. INSTALL WATER INLET PIPE

(a) Install the water inlet pipe with the 2 bolts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

(b) Install the water by-pass hose.

18. INSTALL CYLINDER HEAD SUB-ASSEMBLY (for Bank 1)

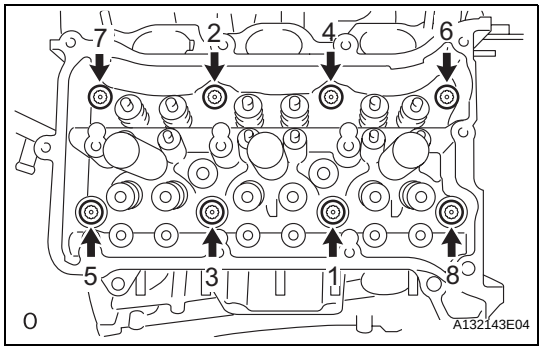
(a) Check the piston protrusions for each cylinder.
(1) Clean the cylinder block with solvent.
(2) Set the piston of the cylinder to be measured to slightly before TDC.



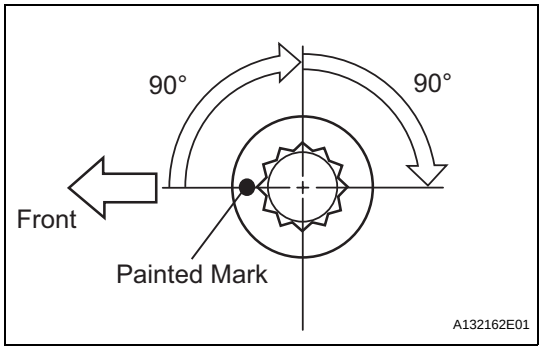
(b) Place the cylinder head gasket on the cylinder block surface with the front face of the Lot No. stamp upward.
NOTICE:
- **Be careful of the installation direction.**
- **Gently place the cylinder head in order not to damage the gasket with the bottom part of the head.**

(c) Place the cylinder head on the cylinder block.
NOTICE:
Ensure that no oil is on the mounting surface of the cylinder head.
HINT:
The cylinder head bolts are tightened in 3 progressive steps.

(d) Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.



(e) Step 1
(1) Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 8 cylinder head bolts with the plate washers in several steps, in the sequence shown in the illustration.
Torque: 36 N*m (367 kgf*cm, 27 ft.*lbf)



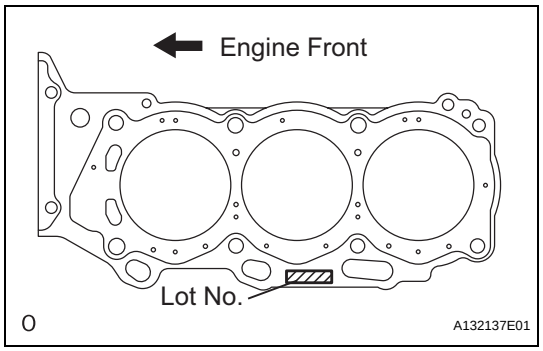
(f) Step 2
(1) Mark the cylinder head bolt head with paint as shown in the illustration.
(2) Tighten the cylinder heads bolts another 90° in the sequence shown in step 1.

(g) Step 3
(1) Tighten the cylinder head bolts by an additional 90° in the sequence shown in step 1.
(2) Check that the painted mark is now facing rearward.

19. INSTALL CYLINDER HEAD SUB-ASSEMBLY (for Bank 2)

(a) Check the piston protrusions for each cylinder.
(1) Clean the cylinder block with solvent.

(2) Set the piston of the cylinder to be measured to slightly before TDC.



(b) Place the cylinder head gasket on the cylinder block surface with the front face of the Lot No. stamp upward.

NOTICE:

- **Be careful of the installation direction.**
- **Gently place the cylinder head in order not to damage the gasket with the bottom part of the head.**

(c) Place the cylinder head on the cylinder block.

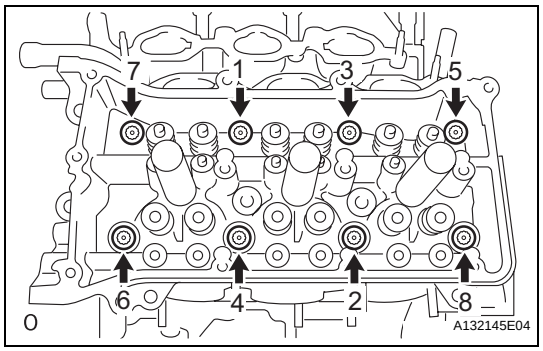
NOTICE:

Ensure that no oil is on the mounting surface of the cylinder head.

HINT:

The cylinder head bolts are tightened in 3 progressive steps.

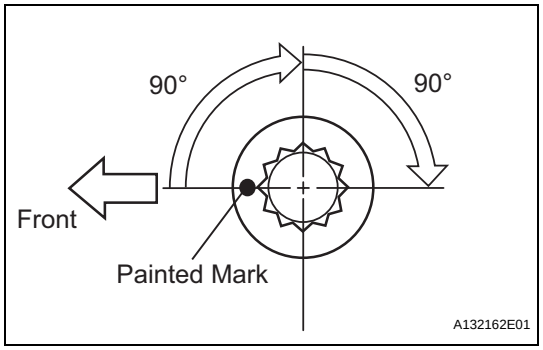
(d) Apply a light coat of engine oil to the threads and under the heads of the cylinder head bolts.



(e) Step 1

(1) Using a 10 mm bi-hexagon wrench, install and uniformly tighten the 8 cylinder head bolts with the plate washers in several steps, in the sequence shown in the illustration.

Torque: 36 N*m (367 kgf*cm, 27 ft.*lbf)



(f) Step 2

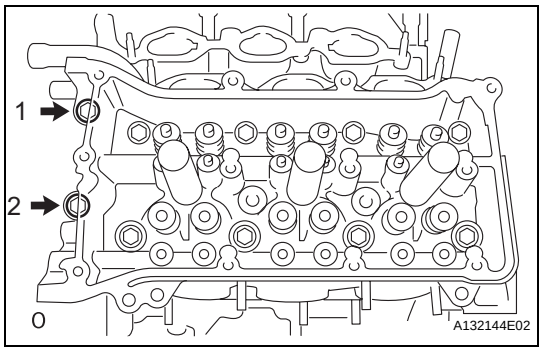
(1) Mark the cylinder head bolt heads with paint as shown in the illustration.

(2) Tighten the cylinder head bolts another 90° in the sequence shown in step 1.

(g) Step 3

(1) Tighten the cylinder head bolts by an additional 90° in the sequence shown in step 1.

(2) Check that the painted mark is now facing rearward.



(h) Install the 2 bolts in the order shown in the illustration.

Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)

20. INSTALL VALVE LASH ADJUSTER ASSEMBLY

(a) Be sure to inspect the valve lash adjuster before installing it (see page EM-75).

(b) Install the lash adjusters.

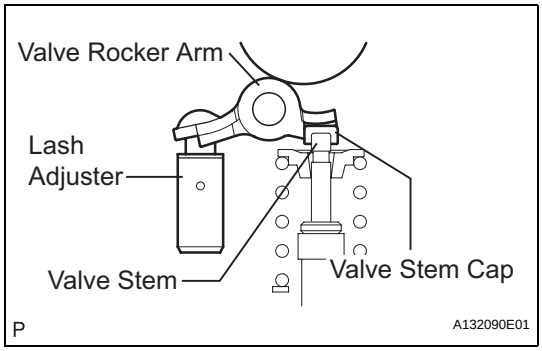
NOTICE:

Install the lash adjuster at the same place it was removed from.

21. INSTALL NO. 1 VALVE ROCKER ARM SUB-ASSEMBLY

(a) Apply engine oil to the lash adjuster tips and valve stem cap ends.

(b) Make sure that the valve rocker arms are installed as shown in the illustration.

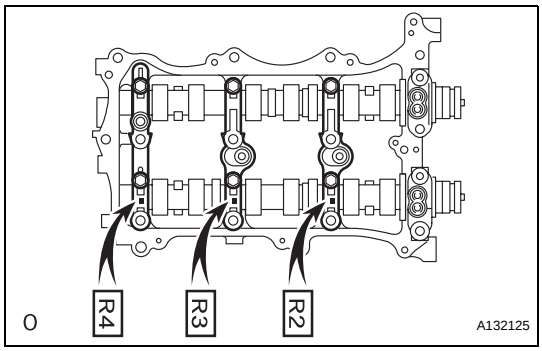


22. INSTALL CAMSHAFT BEARING CAP (for Bank 1)

(a) Apply engine oil to the camshaft journals, camshaft housings and bearing caps.

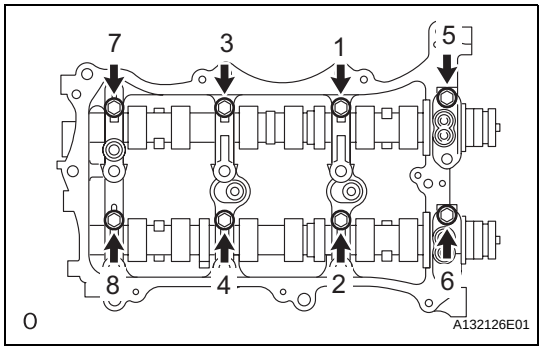
(b) Install the No. 1 camshaft and No. 2 camshaft to the camshaft housing.

(c) Confirm the marks and numbers on the camshaft bearing caps and place them each in their proper position and direction.



(d) Temporarily install the 8 bolts in the order shown in the illustration.

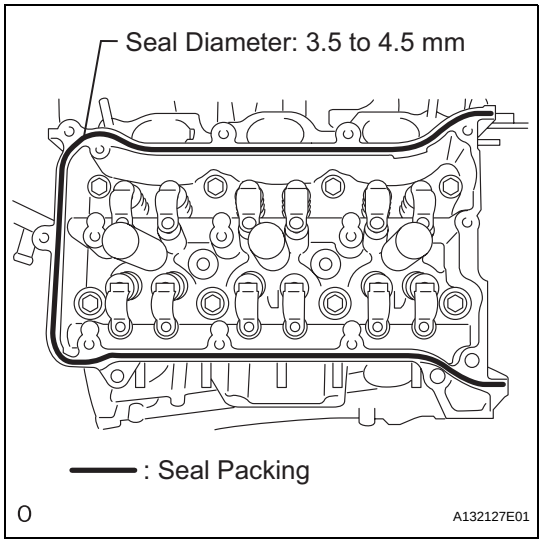
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

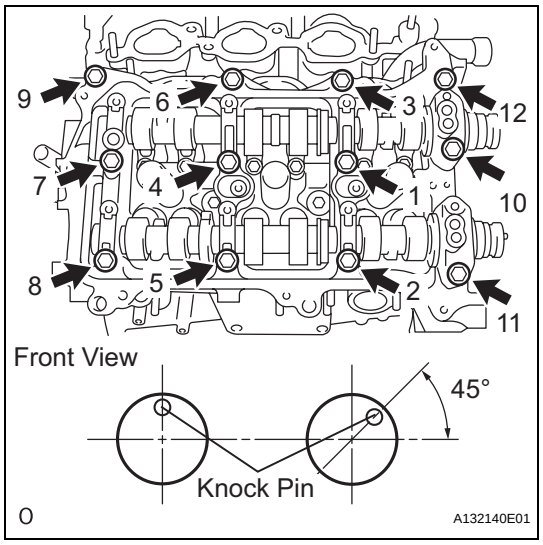


23. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY (for Bank 1)

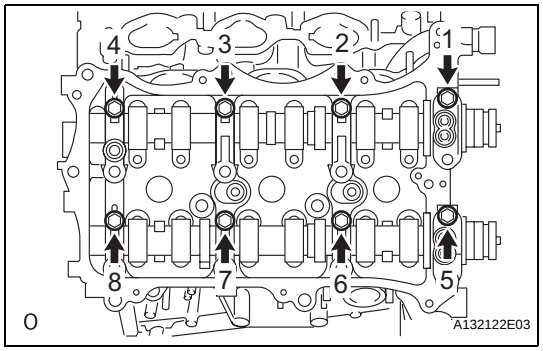
(a) Apply seal packing in a continuous line as shown in the illustration.

Seal packing:
Toyota Genuine Seal Packing Block, Three Bond 1207B or Equivalent
Standard seal diameter:
3.5 to 4.5 mm (0.138 to 0.177 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the camshaft housing within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.**
- **Do not start the engine for at least 2 hours after the installation.**



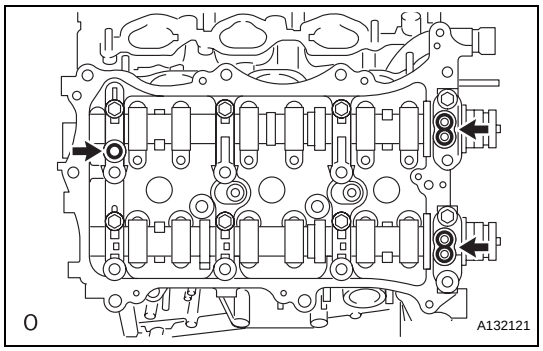


(b) Install the camshaft housing, and install the 12 bolts in the order shown in the illustration.
Torque: 28 N*m (286 kgf*cm, 21 ft.*lbf)
NOTICE:
Make sure that the knock pin of the camshaft is positioned as shown in the illustration before installing the camshaft housing.

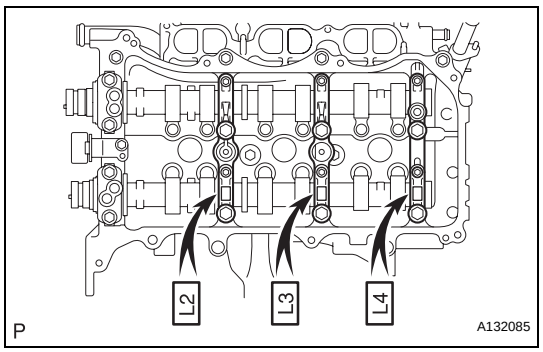


(c) Tighten the 8 bolts in the order shown in the illustration.
Torque: 16 N*m (163 kgf*cm, 12 ft.*lbf)
NOTICE:
Thoroughly wipe clean any seal packing.

EM

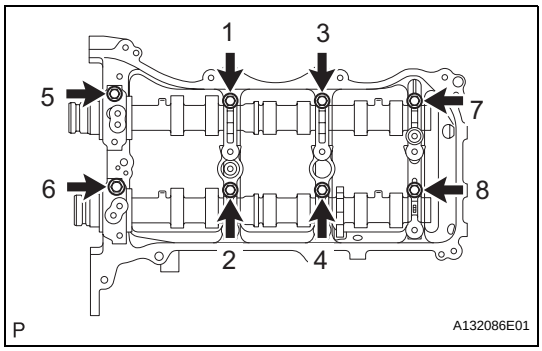


(d) Install 3 new gaskets.



24. INSTALL CAMSHAFT BEARING CAP (for Bank 2)

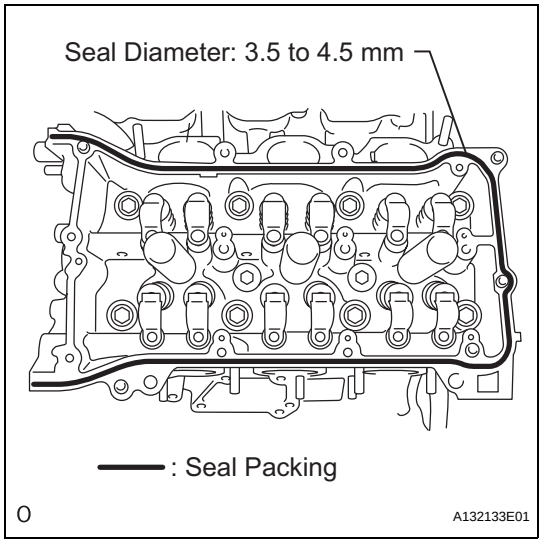
(a) Apply engine oil to the camshaft journals, camshaft housings and bearing caps.
(b) Install the camshaft No. 3 and camshaft No. 4 to the camshaft housing.
(c) Confirm the marks and numbers on the camshaft bearing caps and place them each in their proper position and direction.



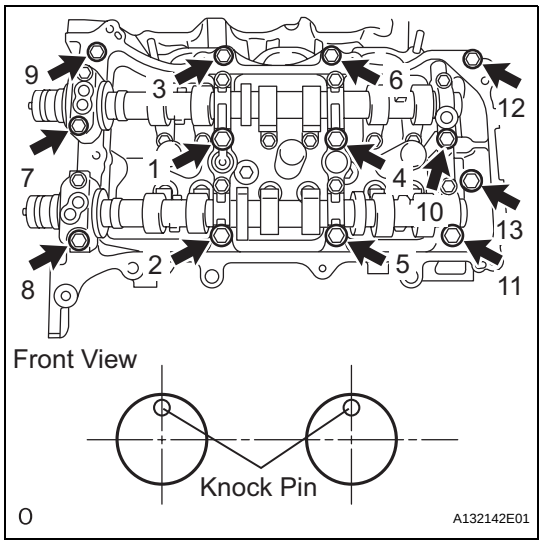
(d) Temporarily install the 8 bolts in the order shown in the illustration.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

25. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY (for Bank 2)

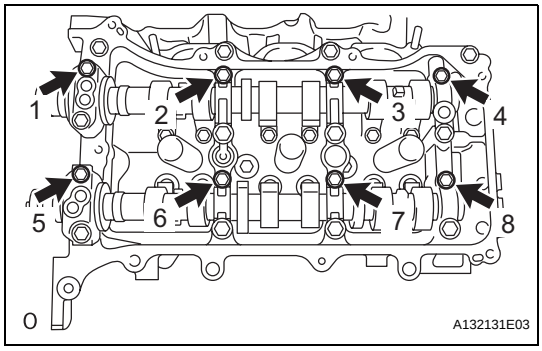
(a) Apply seal packing in a continuous line as shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Block, Three Bond 1207B or Equivalent
Standard seal diameter:
3.5 to 4.5 mm (0.138 to 0.177 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the camshaft housing within 3 minutes and tighten the bolts within 15 minutes after applying seal packing.**
- **Do not start the engine for at least 2 hours after the installation.**

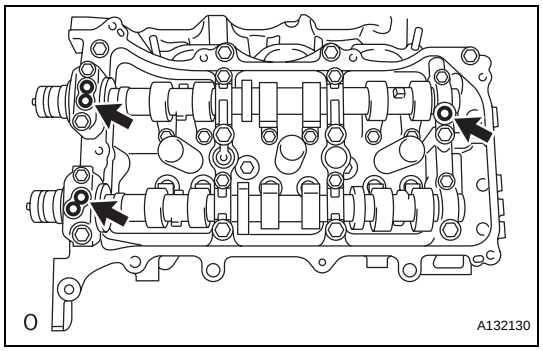


(b) Install the camshaft housing and tighten the 13 bolts in the order shown in the illustration.
Torque: 28 N*m (286 kgf*cm, 21 ft.*lbf)
NOTICE:
Make sure that the knock pin of the camshaft is positioned as shown in the illustration before installing the camshaft housing.

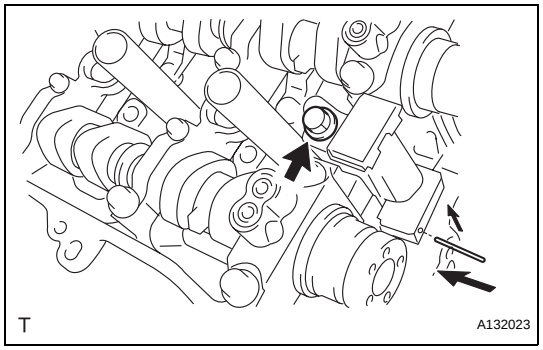


(c) Tighten the 8 bolts in the order shown in the illustration.
Torque: 16 N*m (163 kgf*cm, 12 ft.*lbf)
NOTICE:
Thoroughly wipe clean any seal packing.





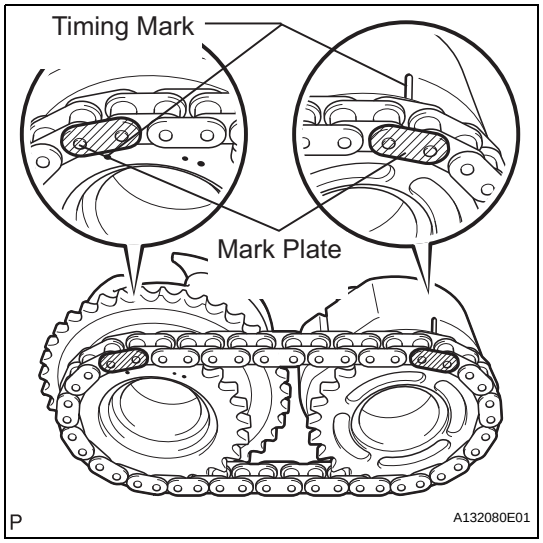
(d) Install 3 new gaskets.



26. INSTALL NO. 2 CHAIN TENSIONER ASSEMBLY

(a) Install the chain tensioner with the bolt.
Torque: 21 N*m (214 kgf*cm, 15 ft.*lbf)

(b) While pushing in the tensioner, insert a pin of ϕ1.0 mm (0.039 in.) into the hole to fix it in place.

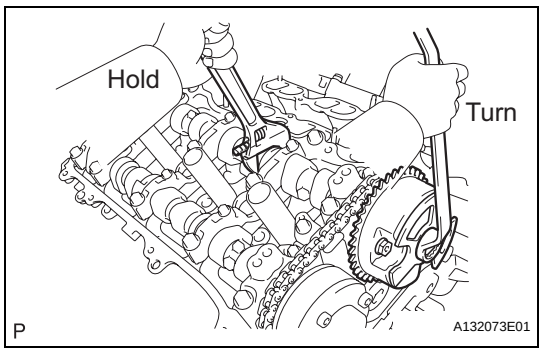


27. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 1)

(a) Align the mark plate (yellow) with the timing marks (1 dot mark) of the camshaft timing gears as shown in the illustration.

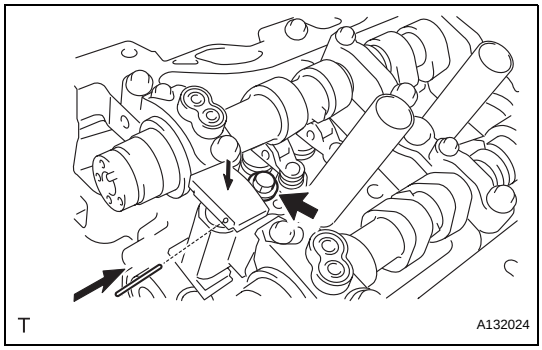
(b) Apply a small amount of engine oil to the bolt threads and bolt-seating surface.

(c) Align the knock pin of the camshaft with the pin hole of the camshaft timing gear. Install the camshaft timing gear and camshaft timing exhaust gear with the No. 2 chain installed.



(d) Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.
Torque: 100 N*m (1,020 kgf*cm, 74 ft.*lbf)

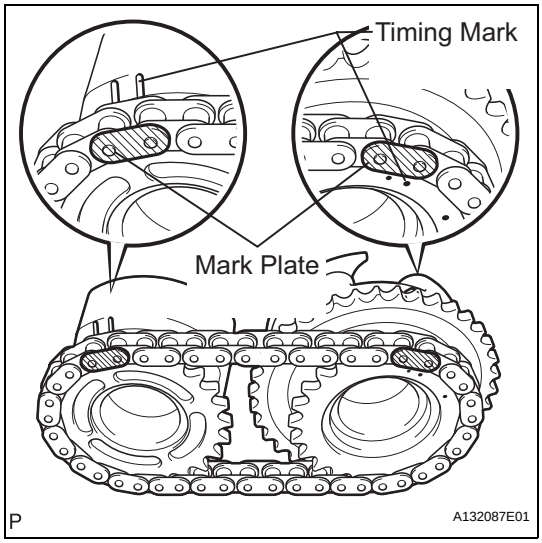
(e) Remove the pin from the No. 2 chain tensioner.



28. INSTALL NO. 3 CHAIN TENSIONER ASSEMBLY

(a) Install the chain tensioner with the bolt.
Torque: 21 N*m (214 kgf*cm, 15 ft.*lbf)

(b) While pushing in the tensioner, insert a pin of ϕ1.0 mm (0.039 in.) into the hole to fix it in place.

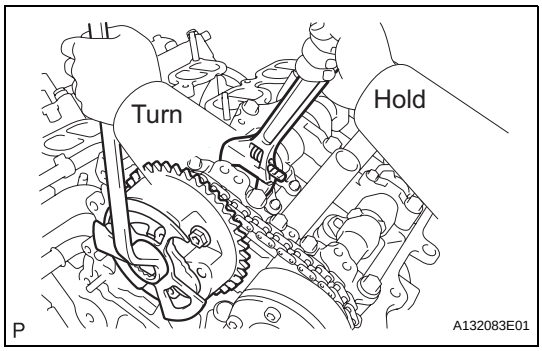


29. INSTALL CAMSHAFT TIMING GEARS AND NO. 2 CHAIN (for Bank 2)

(a) Align the mark plate (yellow) with the timing marks (2 dot mark) of the camshaft timing gears as shown in the illustration.

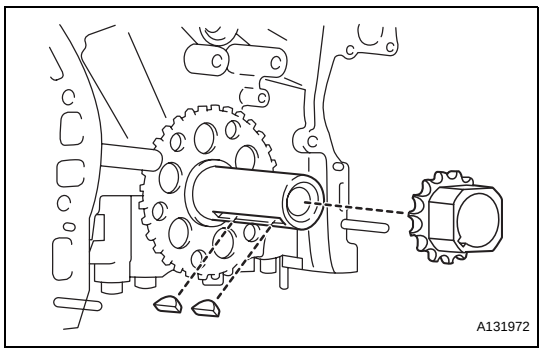
(b) Apply a small amount of engine oil to the bolt threads and bolt-seating surface.

(c) Align the knock pin of the camshaft with the pin hole of the camshaft timing gear. Install the camshaft timing gear and camshaft timing exhaust gear with the No. 2 chain installed.



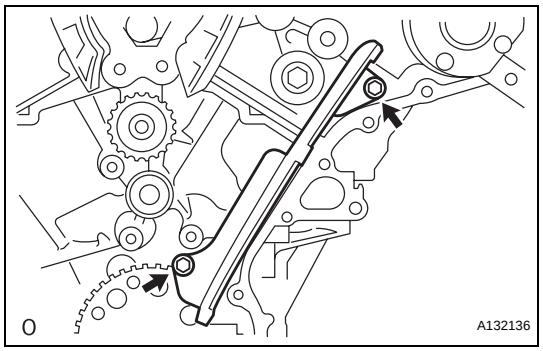
(d) Hold the hexagonal portion of the camshaft with a wrench, and tighten the 2 bolts.
Torque: 100 N*m (1,020 kgf*cm, 74 ft.*lbf)

(e) Remove the pin from the No. 2 chain tensioner.



30. INSTALL CRANKSHAFT TIMING GEAR OR SPROCKET

(a) Install the timing gear set keys and timing gear as shown in the illustration.



31. INSTALL NO. 1 CHAIN VIBRATION DAMPER

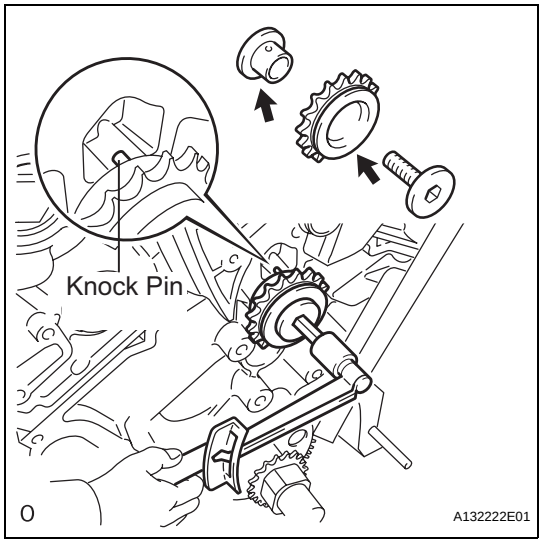
(a) Install the chain vibration damper with the 2 bolts.
Torque: 23 N*m (235 kgf*cm, 17 ft.*lbf)

32. INSTALL NO. 2 CHAIN VIBRATION DAMPER

(a) Install the 2 chain vibration damper.

33. INSTALL IDLE SPROCKET ASSEMBLY

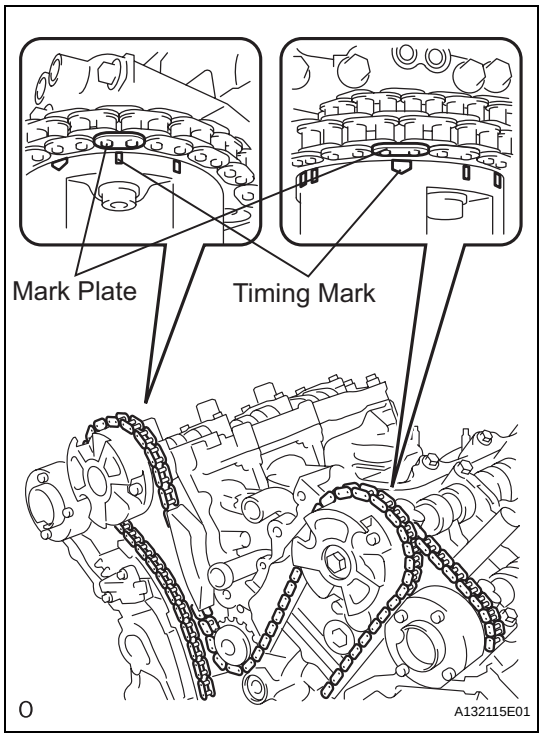
(a) Apply a light coat of engine oil to the rotating surface of the No. 1 idle gear shaft.



(b) Temporarily install the No. 1 idle gear shaft and idle sprocket with the No. 2 idle gear shaft while aligning the knock pin of the No. 1 idle gear shaft with the knock pin groove of the cylinder block.
NOTICE:
Be careful of the idle gear direction.

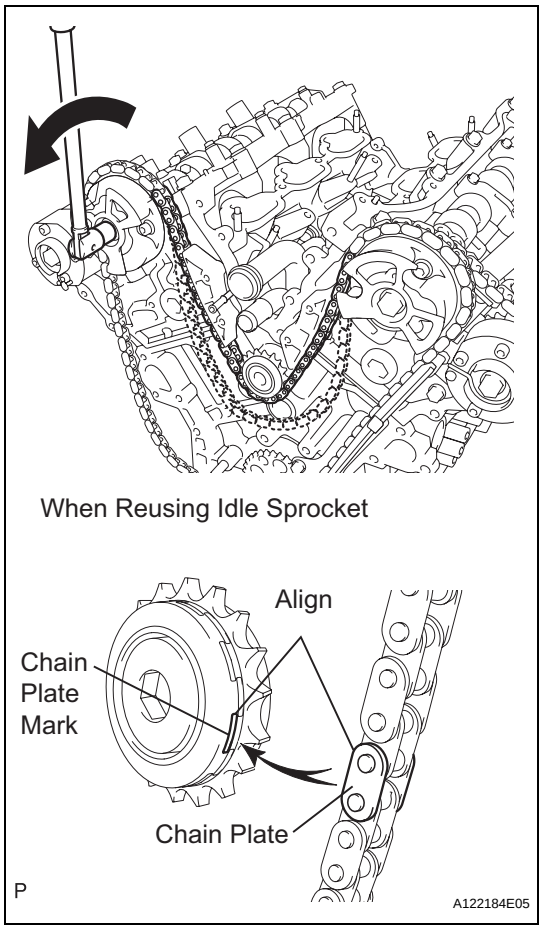
(c) Using a 10 mm hexagon wrench, tighten the No. 2 idle gear shaft.
Torque: 60 N*m (612 kgf*cm, 44 ft.*lbf)

EM



34. INSTALL CHAIN SUB-ASSEMBLY

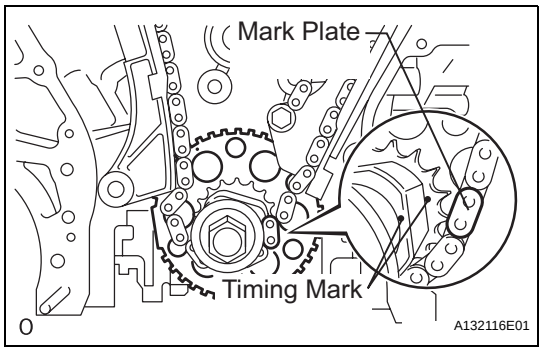
(a) Align the mark plate and timing mark as shown in the illustration and install the chain.
NOTICE:
Do not pass the chain over the crankshaft, just put it on it.
HINT:
The chain mark plate is orange.



(b) Turn the camshaft timing gear on the bank 1 counterclockwise to tighten the chain between the banks.

NOTICE:

If reusing the idle sprocket, align one of the idle sprocket's chain plate marks with one of the chain's chain plates when installing the idle sprocket.

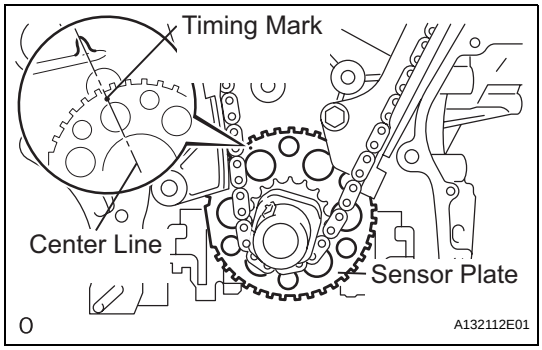


(c) Align the mark plate and timing mark as shown in the illustration and install the chain onto the crankshaft timing gear.

HINT:

The chain mark plate is yellow.

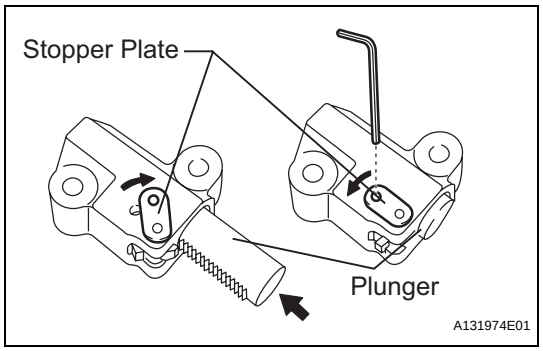
(d) Temporarily tighten the pulley set bolt.



(e) Turn the crankshaft clockwise to set it to the bank 1 block bore center line (TDC / compression).

35. INSTALL CHAIN TENSIONER SLIPPER

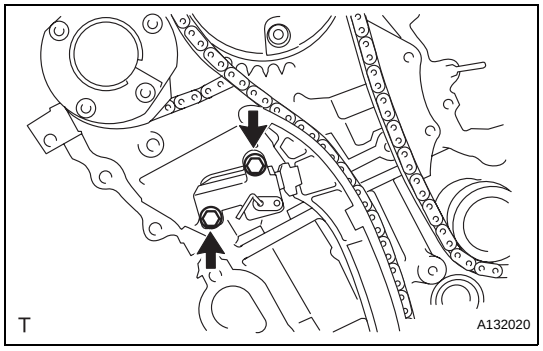
(a) Install the chain tensioner slipper.



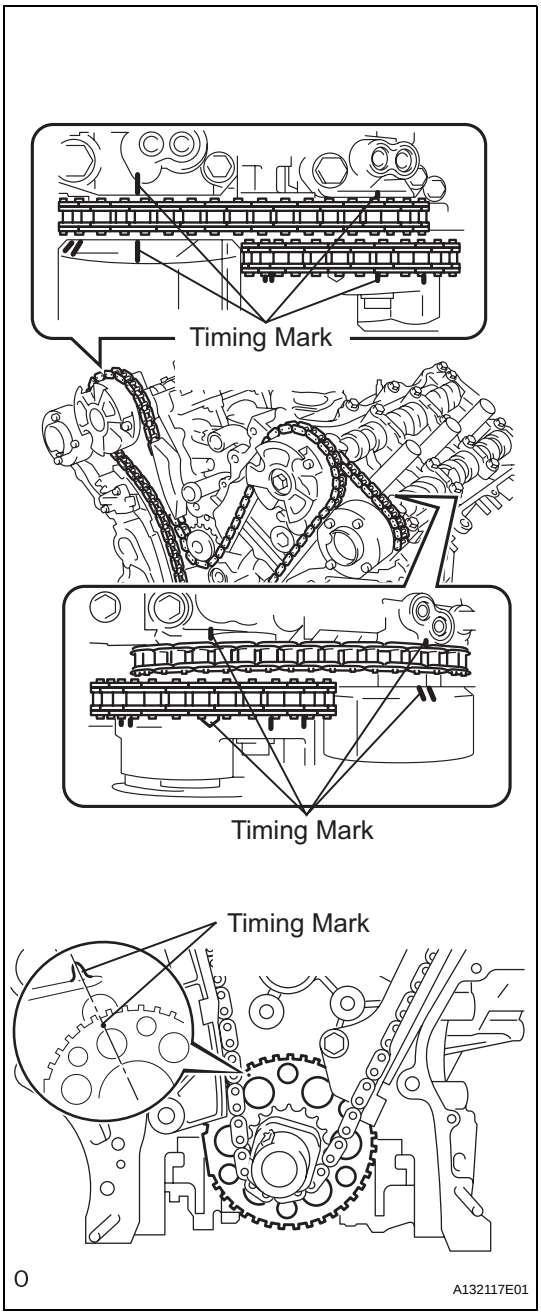
36. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY

(a) Move the stopper plate upward to release the lock, and push the plunger deep into the tensioner.

(b) Move the stopper plate downward to set the lock, and insert a hexagon wrench into the hole of the stopper plate.



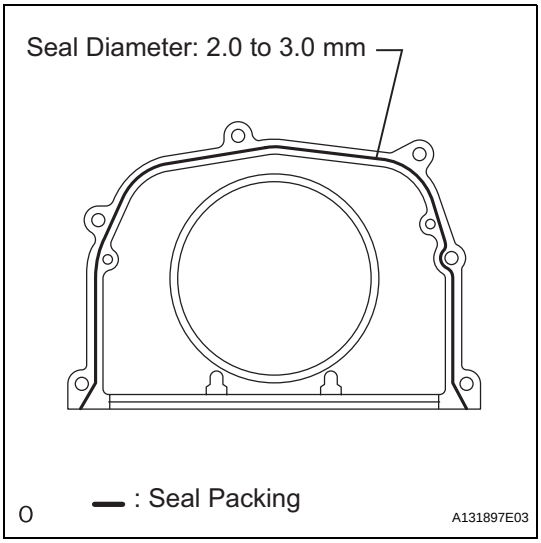
(c) Install the chain tensioner with the 2 bolts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



(d) Remove the lock pin of the chain tensioner. Check that each timing mark is aligned with the crankshaft at the TDC / compression.
(e) Remove the pulley set bolt.

37. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY (w/ Oil Pump) (See page LU-17)

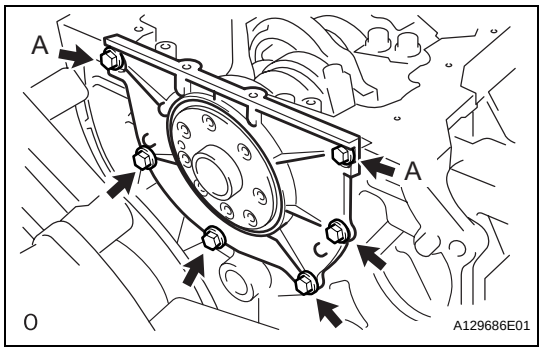
38. INSTALL WATER PUMP ASSEMBLY (See page CO-13)



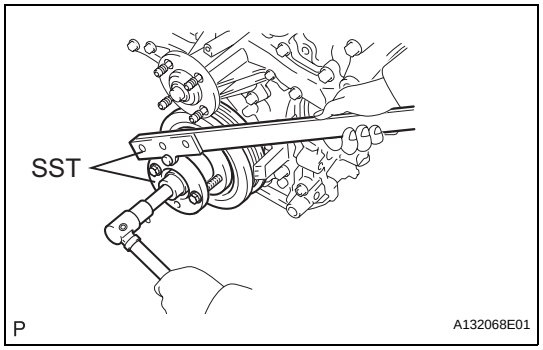
39. INSTALL ENGINE REAR OIL SEAL RETAINER

(a) Apply seal packing in a continuous line as shown in the illustration.

Seal packing:
Toyota Genuine Seal Packing Block, Three Bond 1207B or Equivalent
Standard seal diameter:
2.0 to 3.0 mm (0.079 to 0.118 in.)
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 2 hours after the installation.**

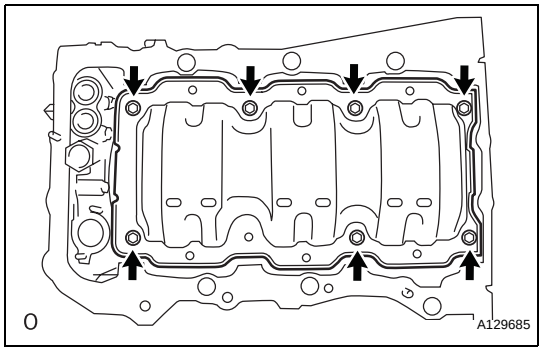


(b) Install the oil seal retainer with the 6 bolts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)
NOTICE:
Apply adhesive 1324 to the 2 bolts labeled A.
Adhesive:
Toyota Genuine Adhesive 1324, Three Bond 1324 or Equivalent



40. INSTALL CRANKSHAFT PULLEY
(a) Align the pulley set key with the key groove of the pulley, and slide on the pulley.
(b) Using SST, install the pulley bolt.
SST 09213-70011 (09213-70020), 09330-00021
Torque: 250 N*m (2,549 kgf*cm, 184 ft.*lbf)

EM



41. INSTALL OIL PAN BAFFLE PLATE
(a) Install the oil pan baffle plate with the 7 bolts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

42. INSTALL OIL PAN SUB-ASSEMBLY (See page LU-21)

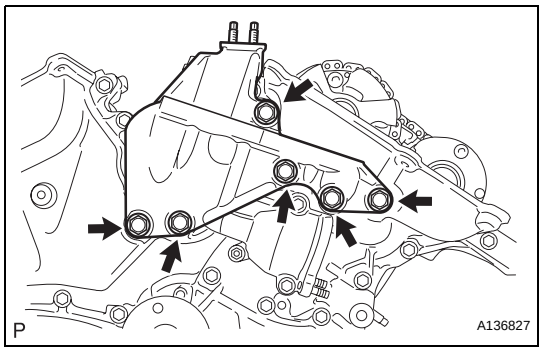
43. INSTALL OIL STRAINER SUB-ASSEMBLY (See page LU-22)

44. INSTALL NO. 2 OIL PAN SUB-ASSEMBLY (See page LU-22)

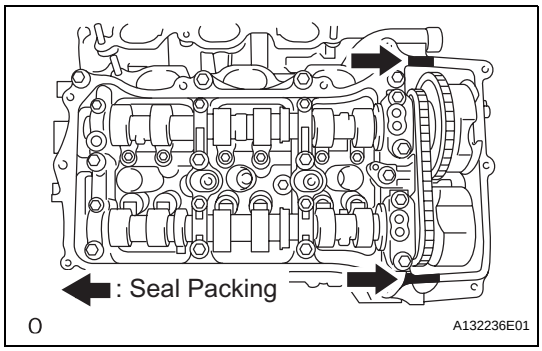
45. INSTALL OIL FILTER ELEMENT (See page LU-5)

46. INSTALL OIL FILTER CAP SUB-ASSEMBLY (See page LU-5)

47. INSTALL WATER INLET HOUSING (See page CO-14)



48. INSTALL FRONT NO. 1 ENGINE MOUNTING BRACKET
(a) Install the engine mounting bracket with the 6 bolts.
Torque: 54 N*m (551 kgf*cm, 40 ft.*lbf)
NOTICE:
- **Install the water inlet and mounting bracket within 15 minutes after installing the chain cover.**
- **Do not start the engine for at least 2 hours after the installation.**

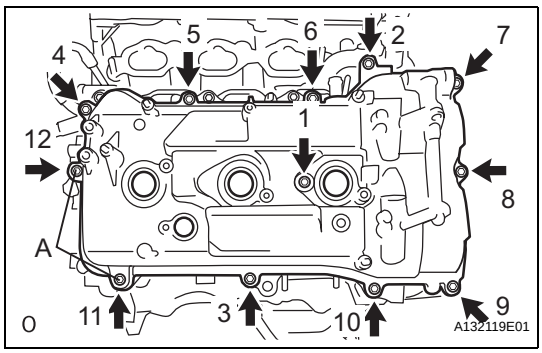


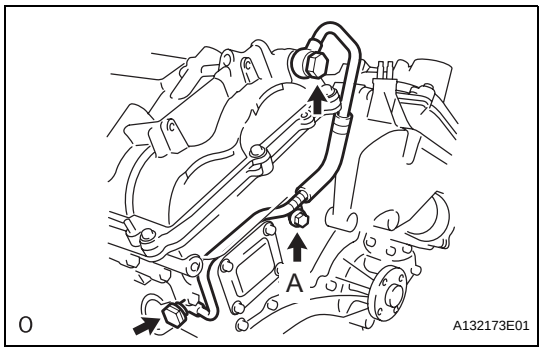
49. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 1)

(a) Apply seal packing as shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Block, Three Bond 1207B or Equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 2 hours after the installation.**

(b) Install the gasket to the head cover.

(c) Install the head cover with the 12 bolts in the order shown in the illustration.
Torque: 21 N*m (214 kgf*cm, 15 ft.*lbf) for bolt A
10 N*m (102 kgf*cm, 7 ft.*lbf) for except bolt A
HINT:
Make sure the tightening torque of bolt 1and 11 in correct.





50. INSTALL OIL PIPE

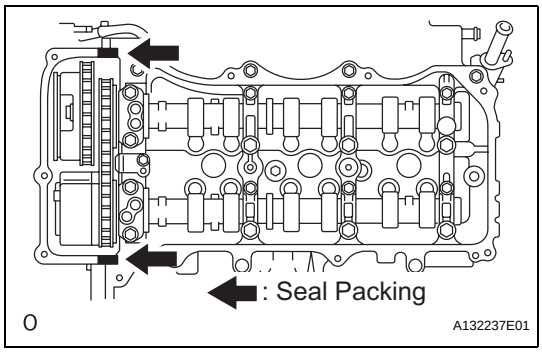
(a) Make sure that there is no foreign matter on the mesh of the oil control valve filter.

(b) Install the oil control valve filter to the oil pipe union. Install 2 new gaskets and temporarily install the oil pipe (on the head cover side) with the oil pipe union.
NOTICE:
Remove any oil from the contact surface.

(c) Install a new gasket and temporarily install the oil pipe (on the cylinder head side) with the oil pipe union.
NOTICE:
Remove any oil from the contact surface.

(d) Install bolt A to the cylinder head.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

(e) Tighten the 2 oil pipe union bolts.
Torque: 65 N*m (663 kgf*cm, 48 ft.*lbf)

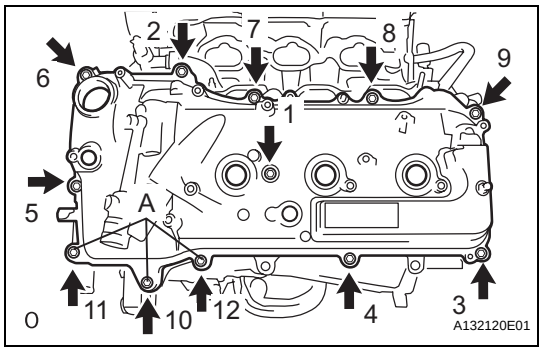


51. INSTALL CYLINDER HEAD COVER SUB-ASSEMBLY (for Bank 2)

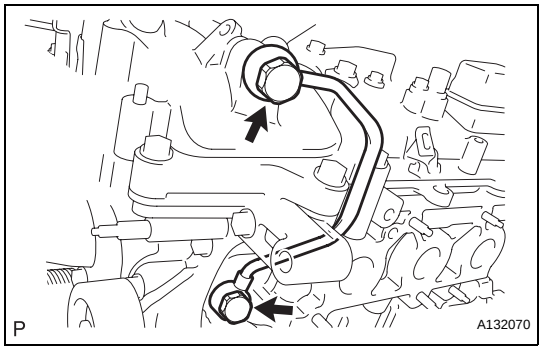
(a) Apply seal packing as shown in the illustration.
Seal packing:
Toyota Genuine Seal Packing Block, Three Bond 1207B or Equivalent
NOTICE:
- **Remove any oil from the contact surface.**
- **Install the crankcase within 3 minutes after applying seal packing.**
- **Do not start the engine for at least 2 hours after the installation.**

(b) Install the gasket to the head cover.

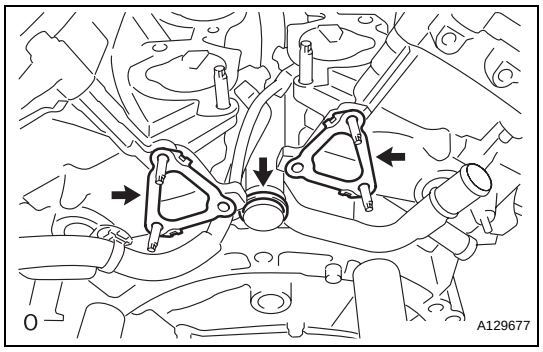
EM



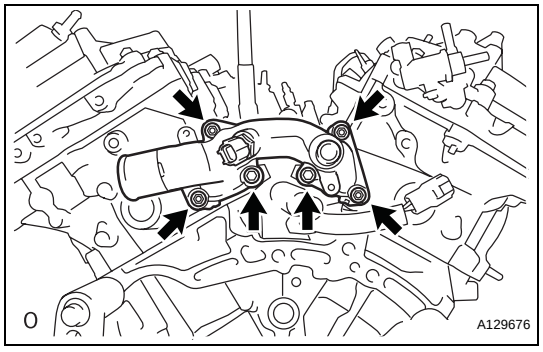
(c) Install the head cover with the 12 bolts in the order in the illastration.
Torque: 21 N*m (214 kgf*cm, 15 ft.*lbf) for bolt A
10 N*m (102 kgf*cm, 7 ft.*lbf) for except bolt A
HINT:
Make sure the tightening torque of bolts 1 and 10 is correct.



52. INSTALL NO. 1 OIL PIPE
(a) Make sure that there is no foreign matter on the mesh of the oil control valve filter.
(b) Install the oil control valve filter to the oil pipe union. Install 2 new gaskets and temporarily install the oil pipe (on the head cover side) with the oil pipe union.
(c) Install a new gasket and temporarily install the oil pipe (on the cylinder head side) with the oil pipe union.
NOTICE:
Remove any oil from the contract surface.
(d) Tighten the 2 oil pipe union bolts.
Torque: 65 N*m (663 kgf*cm, 48 ft.*lbf)

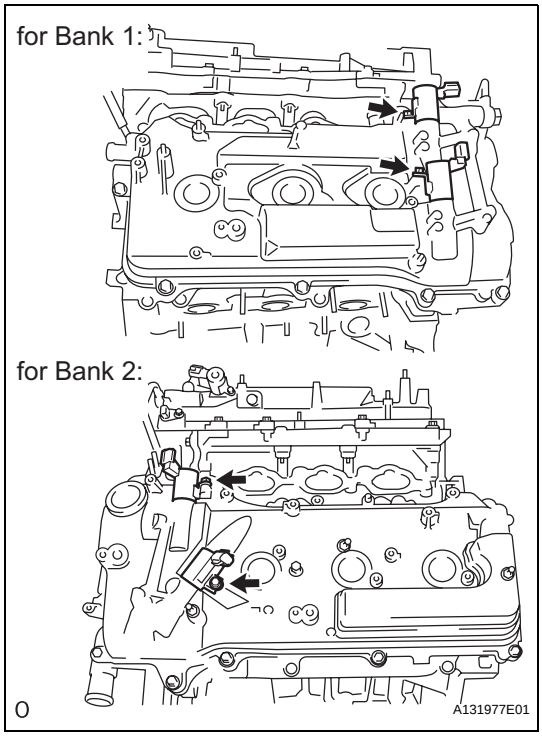


53. INSTALL WATER OUTLET
(a) Install 2 new gaskets and a new O-ring.
(b) Apply soapy water to the O-ring.



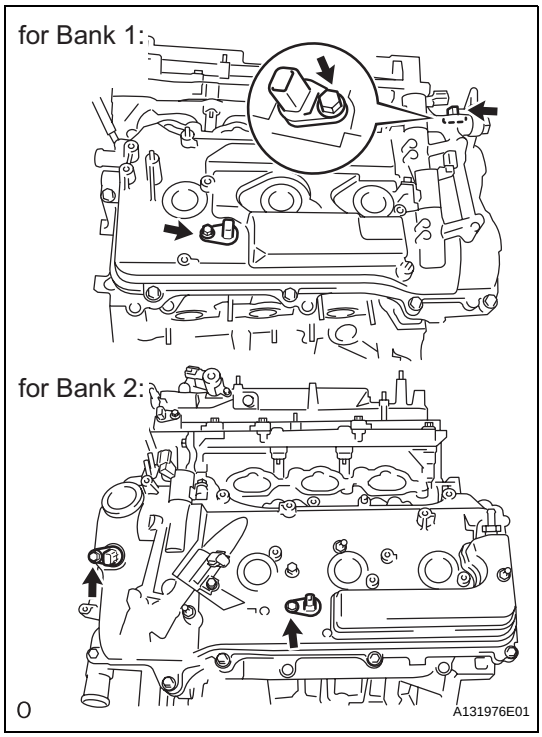
(c) Install the water outlet with the 2 bolts and 4 nuts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

EM



54. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Install the 4 camshaft timing oil control valves with the 4 bolts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)



55. INSTALL VVT SENSOR

(a) Install the 4 VVT sensors with the 4 bolts.
Torque: 10 N*m (102 kgf*cm, 7 ft.*lbf)

56. INSTALL SPARK PLUG

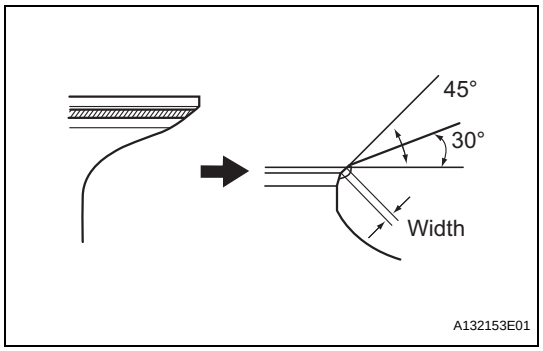
(a) Install the 6 spark plugs.
Torque: 18 N*m (184 kgf*cm, 13 ft.*lbf)

REPAIR

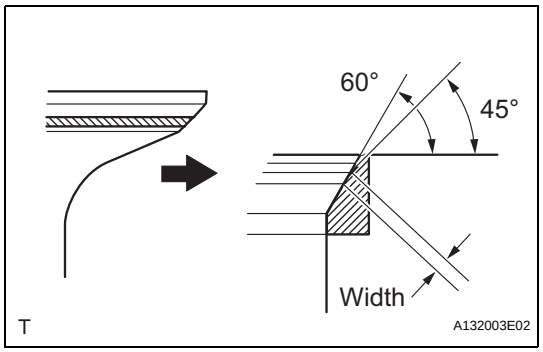
1. REPAIR INTAKE VALVE SEAT

NOTICE:

Keep the lip free from foreign matter.



(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



(b) If the seating is too low on the valve face, use 60° and 45° cutters to correct the seat.

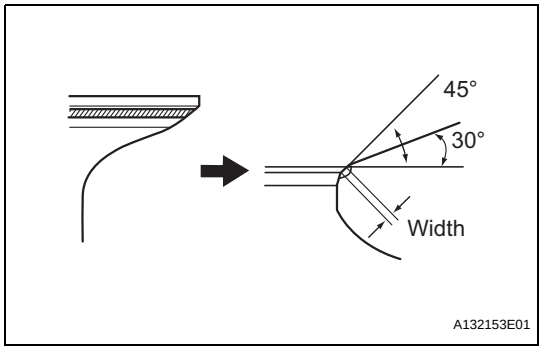
(c) Hand-lap the valve and valve seat with an abrasive compound.

(d) Check the valve seating position.

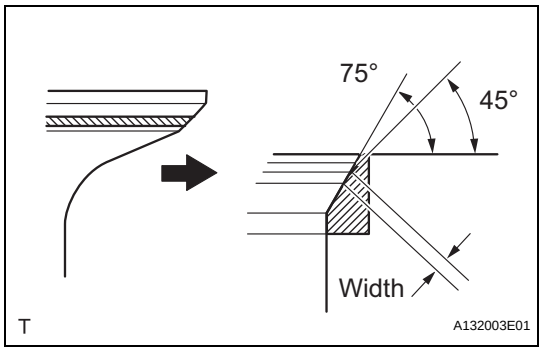
2. REPAIR EXHAUST VALVE SEAT

NOTICE:

Keep the lip free from foreign matter.



(a) If the seating is too high on the valve face, use 30° and 45° cutters to correct the seat.



(b) If the seating is too low on the valve face, use 45° and 75° cutters to correct the seat.

(c) Hand-lap the valve and valve seat with an abrasive compound.

(d) Check the valve seating position.

EM